THE NEW SOVIET LIBRARY

(10)

THE UNIFIED TRANSPORT SYSTEM OF THE U.S.S.R.

THE NEW SOVIET LIBRARY

1. SUPPLY AND TRADE IN THE U.S.S.R.
   by NODEL, Editor of *Supply, Co-operation, Trade*
2. HEALTH PROTECTION IN THE U.S.S.R.
   by SEMASHKO, Former People's Commissar for Health, now Chairman of the Child Commission of the C.E.C.
3. THE SOVIET THEATRE (*with 36 plates*)
   by MARKOV, Literary Director of the Moscow Art Theatre
4. THE INDUSTRIAL REVOLUTION IN THE U.S.S.R.
   by TAL, Head of the Department of Economics of the U.S.S.R. in the Sverdlov Communist University
5. COLLECTIVISED AGRICULTURE
   by GAISTER, Member of the Presidium of Gosplan
6. LABOUR
   by KRAVAL, Deputy Chairman of the Central Board of Economic Statistics
7. THE SOVIET STATE AND THE SOLUTION OF THE PROBLEM OF NATIONALITIES
8. FOREIGN TRADE IN THE U.S.S.R.
   by YANSON, Former Chairman of Arcos
9. THE SOVIET LEGAL SYSTEM
10. THE UNIFIED TRANSPORT SYSTEM OF THE U.S.S.R.
    by TVERSKOI, Director of the Transport Section, State Planning Commission of the U.S.S.R.
11. FINANCE
    by GRINKO, MINISTER OF FINANCE
12. SCIENCE AND EDUCATION IN THE U.S.S.R.
    by PINKEVICH, Professor and Dean of the Second Moscow University
13. LITERATURE
    by ZELINSKY

All 3/6 except No. 3, which is 5/-

* Already published

PUBLISHER'S ADVERTISEMENT

A GREAT NUMBER of books on Soviet Russia have come from the press during recent years—but mainly impressions of the Soviet régime by visitors to or residents in the Soviet Union. Indeed, the lack of really precise and definite information has been as noticeable as the plethora of impressions.

We accordingly requested prominent Soviet officials to prepare a series of books which would *describe* and *explain* the Soviet system and method in the various branches of economic, political, national, social, and artistic life. We have italicised the words *describe* and *explain*; for the intention is simply to tell us, for instance, *how* labour is organised, *how* the problem of nationalities is being dealt with, *how* a collective farm works, *how* commodities are distributed, *how* justice is administered, and so on.

V. G.

NOTE ON K. N. TVERSKOI

K. N. TVERSKOI was born in 1902. After having worked for a number of years as a labourer, he completed the course of electrical repairing and the workers' faculty course at the Leningrad Electro-technical Institute. He then entered the Institute of Red Professors, and in 1930 graduated at the Economic Institute of Red Professors, specialising in transport.

While preparing for further scientific work, K. N. Tverskoi has carried on cultural and educational work in factories, and has taught in higher educational institutions. Since 1932 he has been working as professor in the Economic Institute of Red Professors.

K. N. Tverskoi does not restrict himself to teaching and scientific work, but actively participates in practical work. He is in the State Planning Commission of the Council of People's Commissaries of the U.S.S.R. and is director of its Transport Section.

He takes a most active part in planning the reconstruction of the Soviet transport system. At the All-Union Conference on the Electrification of the U.S.S.R. he delivered an address on the problems and methods of electrifying the transport system. He was also one of the organisers of the All-Union Conference on the reconstruction of a unified transport network in the U.S.S.R. Recently he has taken an active part in working out the second five-year plan for the development of the national economy of the U.S.S.R.

K. N. Tverskoi is the author of *Transport Reconstruction* and is also co-author of a textbook on economic policy. He writes for various economic magazines.

THE NEW SOVIET LIBRARY

(10)

THE UNIFIED TRANSPORT SYSTEM OF THE U.S.S.R.

by

K. N. TVERSKOI

LONDON
VICTOR GOLLANCZ LTD
14 Henrietta Street Covent Garden
1935

Printed in Great Britain by
The Camelot Press Ltd., London and Southampton

CONTENTS

INTRODUCTION

IN THE SOVIET UNION all forms of transport by rail, river, sea, air and road are closely related to each other, forming one single system of transport.

Previous to the Revolution air and road transport practically did not exist, while the various institutions controlling ways of communication by rail, river and sea were in constant competition to secure the biggest share of goods and passenger traffic. This conflict also existed in the building up of means of communication.

In a number of cases the construction of railway lines was carried out parallel to water routes with a view to securing part of the cargoes shipped along these water routes. In other instances railway lines were not joined to waterways, because of the fear that this might decrease the trend of freight towards the railway lines. Railway lines were directed towards the land frontiers in order to secure the greatest possible share of goods intended for international markets which had previously been shipped by river or sea routes.

This competition was clearly shown in a constant rate war, which existed not only between the various forms of transport, but also among the railway lines

and shipping routes. For instance, a very keen struggle was carried on by various railway companies for the transport of coal from the Donbas (the basin of the river Don), which could reach Moscow by several trunk lines.

The shipping lines of the Black Sea competed with those of the Baltic Sea to attract the freight from the largest possible areas. A similar struggle was carried on between the Baltic and the White Sea, between their principal ports—Petersburg and Archangel—to secure the cargoes from the timber zones.

This competition, which assumed various forms, inevitably accompanied the growth of transport in pre-revolutionary Russia. For this reason one single system of transport in the country could not exist.

The nationalisation of the means of transport, which was carried out after the November Revolution of 1917, put an end to this competition. It created co-operation in the development of all forms of transport for the purpose of satisfying the requirements of the nation's economy in the most rational and complete manner. Instead of the separate lines of transport in continual competition with each other, one single system of transport was established, and its development and the distribution of work among the various means of transport were carefully planned.

In this transport system of the U.S.S.R. each form of transport has its particular place, and fulfils its own task in the general development of Soviet economy.

The shipping routes have to provide for the foreign trade of the Soviet Union and establish connections between the U.S.S.R. and other countries. They also play an important part in inter-territorial transport in the U.S.S.R., connecting the Black Sea with the Baltic Sea, and the south of the U.S.S.R. with the Far East (Black Sea–Vladivostok). On the Black Sea and the Sea of Azov they provide a connection between the various national republics—the Ukraine, the Crimea, the Azov-Black Sea district, and the Transcaucasian Federation. The shipping lines on the Caspian Sea provide connecting links between Eastern Transcaucasia, Central Asia, Kazakstan, the Lower Volga and the Northern Caucasus.

The shipping routes of the Soviet North connect the Leningrad district with the northern territories, the north of the Urals, Siberia and the Far East.

The principal object of railway transport in the U.S.S.R. is to form the main connecting links between the various regions. The principal lines are those connecting the European part of the U.S.S.R. with the East, as well as those connecting Central Asia and Kazakstan on the one side and Siberia, the Ural, Donbas and the central districts of the U.S.S.R. on the other. The railway lines also assist the shipping routes in the maintenance of international connections by carrying goods to the western land frontier.

The Soviet Union covers an area of 21,274,000

sq. kilometres with a population of 168 million people. All over this immense area there are big industrial and agricultural centres which require means of transport of varied forms. The railway lines alone could not satisfy these varied and rapidly growing requirements and are greatly assisted in their work by river transport.

River transport is of special importance for traffic between the southern and northern regions of the U.S.S.R. Waterways like the Volga and Dnieper, with their large tributaries, are of immense importance for the transport of goods between Transcaucasia, the Northern Caucasus and the Azov-Black Sea districts and the Lower and Central Volga, the Gorki, Ivanovo, Moscow and Ural districts, the Tartar Republic, Bashkiria and Kazakstan, as well as the Ukraine, the western and the White-Russian districts.

The river basins of Siberia and the far north, which in Tsarist Russia were very incompletely exploited, now play an important part as inter-regional means of communication.

Many river basins, especially in the north and in Siberia, and particularly those of the Onega, Mezen, Pechora, Hatanga, Lena, Indigirka and Kolyma, remained completely isolated under the Tsardom, as they were not linked up with other means of transport. In order to put an end to this isolation all the more important river basins have now been connected with the All-Union transport

system either by the construction of railway lines, as in the neighbourhood of Lake Balkhash, or by establishing road services (as in the case of the vast Lena basin), or by making use of sea routes (as in the case of the Kolyma, Indigirka, Pechora, etc.). Through the establishment of these supplementary links, all the vast river basins and their populations have been given transport connections with all districts of the U.S.S.R.

Road motor transport, which has been called into life only since the establishment of the Soviet régime, has at once taken a very important part in the transport system of the U.S.S.R. Its principal object is to provide transport within the districts ; in this it is assisted by narrow-gauge railways and transport by horses. Its object is not only to transport goods to and from railway stations, river basins and seaports, but to form an independent means of transport within the districts. Motor transport must relieve the railways of short-distance traffic, allowing them to concentrate on inter-regional transport. However, transport by motor is only a recent form of communication, and therefore it is not yet able to relieve the railways and river routes of the carrying of local goods. The point is that the trend of development of the various forms of transport is in the direction of using motors chiefly for carrying goods within the districts.

At the present time, however, motors are sometimes used as the means of transport between various

districts. For instance, in Eastern Siberia motor lorries form the connecting link, carrying goods from the railway over a distance of some hundred kilometres to the river Lena, these goods being then shipped by this river to Yakutia. In this case motor lorries represent the only means of communication with Yakutia.

Air transport is quite a new development, which did not exist in Tsarist Russia and was established after the Soviet Government came into power. Now aeroplanes convey mail, newspapers, goods of high value and small bulk and also passengers, and while they help the railways in carrying long distance goods, aeroplanes also play a very important part in those distant parts of the U.S.S.R. which are still deprived of any other means of communication. Aeroplanes have also proved to be very useful in agricultural work, assisting in sowing operations, in the fight against harmful insects, in the cultivation of fields and forests, in the fishing industry, in surveying work, etc.

Thus, all forms of transport—by sea, rail, river, by air, motor and horses—make up a unified transport system for the U.S.S.R. in which every form of transport has its particular place and its particular working sphere ; and all these various forms of transport, assisting each other, accomplish a common task, satisfying in the most rational and complete manner the ever-growing requirements of the country as a whole as well as of its numerous regions.

CHAPTER I

THE PLANNING OF TRANSPORT

THE DEVELOPMENT of the Soviet Union's transport system is determined by a plan drawn up for a definite period of time : a five-year plan ; a one-year plan as part of the five-year plan ; a quarterly plan as part of the one-year plan ; and lastly a monthly plan as part of the quarterly plan.

HOW THE PLAN IS BUILT UP

How is this plan worked out, and what are its principal parts ? The principal divisions of the plan are :

(1) The amount of goods of various kinds to be carried.

(2) The allocation of these goods to the various means of transport, which includes the distribution of the rolling-stock and other means of transport among the various railways, river basins and seas in accordance with the amount of transport to be effected, the amount of labour required, and lastly the condition of the rolling-stock, ships, motors,

etc., which determines the extent of replacement required.

(3) The programme for the repair workshops, which is worked out on the basis of the plans of transport and exploitation of rolling-stock, etc.

(4) The plan of capital investments required to increase the efficiency of the means of transport in accordance with requirements.

(5) The plan for new construction of each kind of transport, which is worked out in dependence on the development of industry, agriculture and other branches of the national economy.

(6) The plan for supplying the transport system with the necessary materials, such as : fuel, building materials, metal, timber, rails, rolling-stock, spare parts, etc.

(7) A labour plan, showing the amount and efficiency of labour required, wages, the training of a staff of new workers and the training methods to be adopted, and the measures for raising the cultural level and living conditions of the workers.

(8) The fixing of freight rates for the various branches of transport and for various goods.

(9) The financial plan of transport receipts and expenditure, and the cost of transport.

These are the principal divisions of the transport plan, each of which has a number of sub-divisions.

THE VOLUME OF TRAFFIC

The amount of goods to be carried is the determining factor of the plan, on which all the remaining parts are based. Therefore it is necessary to devote particular attention to this question.

It is quite obvious that the amount of goods to be carried depends on the production of the various industries, agriculture, timber districts, etc., as well as on the location of the points of production and places of consumption.

First a plan is made of the entire volume of transport of the whole country, independently of the kind of transport by which it will be handled. Only after the compilation of this plan is the work begun of allocating the goods to the various forms of transport. Each form of transport works out a plan for its separate links—railways, river and sea routes, air and motor transport—which again make a working schedule for their dependent links, so that the lowest link and each individual worker knows what particular work has to be carried out.

The working out of the transport plan is based on the plans for other branches of the country's economic system, which give a general indication of the production of raw material, fuel, goods, etc. The industrial plans also show in what regions, in what factories and works and in what quantities these goods will be produced. However, this material is not enough for the establishment of a transport plan :

on the basis of such data only the first part of the plan is worked out, i.e. the kind of goods to be carried, the quantity of each, and the time when it may be expected to be delivered for transport. To draw up a transport plan it is also necessary to know the second point, viz. where, when, and in what quantities the goods are to be delivered. For this purpose schedules are drawn up for the various regions showing the balance of production and consumption for each principal product : for instance, for coal, grain, forage, oil, metals, timber, and building material, etc. On the basis of such regional schedules it may be fairly accurately determined what kinds and quantities of goods will be sent beyond the limits of each region, and also what kinds and quantities of goods are required to be brought into the various regions.

On the basis of such regional estimates of production and consumption, schedules for the inter-regional goods traffic are drawn up for the whole country, connecting the importing regions with those exporting. With regard to the transport of goods within the regions, this is planned in the same way within the limits of the region.

On the basis of these data a plan of transport work is drawn up for a definite period of time. A plan is made, for instance, of the quantity of coal which will have to be transported, from where it will come, and where it will have to be carried, with the length of the runs. The same applies to other kinds of goods (oil, mineral ore, metals, machinery, including

tractors and motor-cars, timber and building materials, sugar, salt, etc.). When this basic information has been secured for each particular kind of goods, a schedule is prepared for the aggregate transport turnover of the whole country, showing the length of the runs and the total kilometre-ton figure of the traffic. The transport plan is prepared not only on a national scale, but also on a regional scale. Each constituent republic of the U.S.S.R., each region and each district knows what amount and what kind of goods have to be despatched, and where they are to be forwarded to ; and, on the other hand, what kind and what amount of goods have to be received.

Not only the transport authorities take part in the compilation of the transport plan ; they are assisted in this task by the managing bodies in the various industries and agriculture, by the organisations controlling the distribution of products, and lastly by the administrative authorities of the republics, regions, territories and districts and their local planning commissions.

ALLOCATION TO VARIOUS FORMS OF TRANSPORT

Such detailed information regarding the flow of goods between and within the various regions forms the principal basis for the rationally planned distribution of the work between the various kinds of transport, and the allocation to each of a definite

amount and type of work, taking into consideration the use of combined means of transport and the possible development of the different kinds of transport. At the present time the necessity for developing communication by water routes and motor transport is being particularly felt in the U.S.S.R.

The goods turnover for each kind of transport is shown in detail—the total amount of goods to be carried, the various kinds of goods and the directions in which the goods are to be forwarded. It is also necessary to specify not only the number of tons, but also what distance the goods are to be carried, i.e. the ton-kilometre data, which provide a complete index of the work to be accomplished by the various forms of transport.

For each kind of transport—the railways, roads, river and sea routes—a detailed flow of traffic is scheduled, based on the amount of work required and the data showing the inter-regional connections. This completes the preparation of the traffic plan, on which all other elements of the transport plan are based. Thus, for instance, the planned volume and range of traffic determines the amount of rolling-stock and other means of transport required, and consequently also the size of orders to be transmitted to industrial concerns for engines, cars, ships, aeroplanes and other means of transport.

Comparison of the planned movement of goods along particular railways and shipping routes with their transporting capacity at once reveals the

necessity of increasing this capacity in accordance with the amount of transport work to be done. For example, on a section A–B, an annual movement of goods to the amount of ten million tons is expected, while its capacity is at present limited to six million tons. Consequently, measures must be taken to increase the capacity of this section, and measures are worked out in accordance with the possibilities, such as : the building of an additional railway line, the electrification of the section, the levelling of the gradients of the track, or supplying the section with more powerful rolling-stock. In accordance with the means selected the amount of capital investment required is determined. Finally the total amount of capital investment is settled, as well as the detailed measures to be taken, and these data are incorporated in the plan.

THE FINANCIAL PART OF THE PLAN

In this way all the component parts of a general transport plan are built up on the basis of the traffic which has to be handled. The financial plan, including the receipts and expenditure, is also based on the traffic plan. The receipts are estimated on the basis of the amount of goods to be carried and the ton-kilometre rates. Other receipts are also taken into account. The expenditure is estimated by the number of manual and office workers, the wages and salaries, the required amount of fuel and its cost, the requirements in lubricating oil and other

material, and its cost, as well as the amortisation of the initial funds and the capital required for the further development of transport.

The complete plan, including the financial plan, forms part of the general plan of the country's economy, and the Government, in confirming the latter, decides on the various assignments from the income of the country, independently of what branch of the country's economy has supplied the income. It may happen, for example, that the income derived from industries will be partly used for the further development of transport, and *vice versa.*

The freight rate policy of the U.S.S.R. is again based on a plan. The rate for each form of transport and each kind of goods carried is determined on the basis of Government decisions in connection with a whole series of economic and political problems at each period. For instance, if the Government considers it necessary to increase the importance of the part played by water routes in the whole transport system, this is taken into consideration in fixing the freight rates : the rates for water transport are lowered, while at the same time the rates for railway transport are raised on those lines which run parallel to the particular water routes.

When the Government proposed to increase the transport of coal from the Donbas by a combined system of railway and water routes, i.e. carrying the coal by rail to Stalingrad, thence shipping it up the

river Volga in order to supply the consumers located along the rivers, the freight rates were lowered on the railway which was to transport the coal from the Donbas to the Volga and also on the shipping lines on that river.

If the object in view is the development of some industry in one of the distant constituent republics of the Soviet Union, this is reflected in the freight rates of the transport system.

In each individual case the question of fixing rates is decided in accordance with the expediency of influencing traffic by such measures from the point of view of the whole economy of the country.

Alterations in the rates of freight are made by the Tariff Committee, which consists of representatives of transport and other economic organisations. Important changes are introduced only after confirmation by the Government.

Freight rates are therefore decided on the basis of the general plan of transport and the general interests of the country's economy. One of the most important determining factors in this question is the cost of transport, which includes the operating expenses on each kilometre-ton of the traffic in question, together with the amount required for amortisation of the initial funds. The average freight rate is usually somewhat higher than the average cost of transport. This is in order that transport should not only pay its operating expenses, but also provide the necessary capital for increasing its capacity.

Consequently, the total sum of receipts at fixed freight rates must be such as to cover all operating expenses and cost of amortisation, and also to furnish the necessary capital for the development of the transport system. However, though this is the general principle in regard to the establishment of freight rates, variations may be introduced to achieve some particular purpose as has been mentioned above.

There are twenty-seven railway lines in the U.S.S.R. As a rule there are equal freight rates for the same kinds of goods. For instance, the ton-kilometre rate for carrying coal is the same on the railway system of the Ukraine as on the railway systems of the Urals and Siberia. This is done to simplify the calculation of rates, as the receipts from each railway are handed over to the general fund of railway transport. The distribution of these receipts is effected according to a plan among the various railways, in accordance with the particular work which each has to carry out in the development of transport ; this development work is by no means the same for the different railways, and is determined by the general economic plan for the whole country.

There is a differentiated table of freight rates for the various kinds of goods, including eighty different classes. Each kind of goods comes within a definite class, with a fixed ton-kilometre rate for various distances.

The plan of freight rates forms part of the general

transport plan, and is a component part of each " perspective " (long-period) and annual plan.

In conclusion it is necessary to note a special feature of this planning, viz. it is not worked out by superior officials of the central administrations. If, for instance, a railway plan has to be prepared, the working out of this plan begins with the lowest links ; their drafts are then referred to the administration of the particular railway, and lastly to the administrative authorities for railway transport as a whole. This plan, in the compilation of which all transport and economic organisations have been participating, is finally handed over to the State Planning Commission of the Council of Soviet Commissaries. Here the plan is examined, and after it has been adjusted and systematised in accordance with general economic plans, it is confirmed by the Government. After this confirmation the plan is handed down from the higher to the lower administrative authorities and made known to all transport workers. After this all the organisations concerned make every effort to carry out the plan, systematically controlling its working and assisting those sections which are lagging behind. The fact that the plan is known among all transport workers guarantees its successful working.

CHAPTER II

THE INHERITANCE FROM TSARIST RUSSIA

INDUSTRY WEAK AND CENTRALISED

THE FORMER Russian Empire was an agricultural country, noted for its economic weakness and its dependence on foreign capital. It exported grain products, timber and agricultural raw material, importing manufactured goods, machinery and equipment for industrial concerns. Tsarist Russia had no strong metallurgical industry. Construction of machinery was still in a very low state of development, and such branches of industry as aviation, construction of motor-cars, tractors and machine tools did not exist. Means of production were not produced. In consequence of this Russia was a weak and dependent country. Vast territories with great natural resources, such as the Far East, Siberia, Kazakstan, Central Asia, the northern provinces, the Volga district, White Russia, and the western provinces, were quite undeveloped. The great mining and manufacturing district of the Urals,

rich in such minerals as coal, iron ore, copper, silver, etc., was inadequately developed. The entire industry of Tsarist Russia was concentrated in four areas: Moscow, Ivanovo, Petersburg, and the Kharkov-Donetz district. These four districts produced more than 75 per cent of all goods manufactured in Tsarist Russia.

The concentration of industrial development in a few districts of European Russia, together with the economic and cultural backwardness of the remote districts, placed the latter in a state of dependence, with the centre as their metropolis. Siberia, Central Asia, the Caucasus, and Transcaucasia became appendages of Central Russia, supplying it with raw materials for industry, but themselves retaining primitive forms of cultivation and a patriarchal-feudal society.

The industry of European Russia was unevenly distributed. Almost the entire metallurgical industry was concentrated in the south of Russia. In 1913 the workers of the Donbas and the Dnieper district produced 74 per cent of the total Russian output of pig iron. The Donetz coal-mining district in 1913 supplied 87 per cent of all the coal mined in Russia. An enormous territory was dependent on one coal district for its supply of coal. The cotton industry was concentrated in the Moscow, Ivanovo and Petersburg districts. More than 50 per cent of the linen industry was located in the Ivanovo district. Sugar production was limited to the Ukraine and

the Central Black Earth district. The entire production of the manufacturing industry of Tsarist Russia was estimated at 10·2 milliards of rubles at the prices of 1926–27. The whole acreage under crops was 105 million hectares, of which only 4·5 million hectares were taken up by plants used for industrial purposes. Only 690,000 hectares were under cotton, and only 650,000 hectares were used for sugar beet.

In regard to its technical and economic development, the degree of exploitation of productive forces and the capacity of its industry, Tsarist Russia was far behind other countries. As Stalin once said :

" The history of ancient Russia shows that the country was continually being beaten because of its backwardness. It was beaten by the Mongolian khans ; by the Turkish bekhs ; by the Swedish feudal lords ; it was beaten by the Polish-Lithuanian squires ; beaten by the Anglo-French capitalists ; by the Japanese barons. It was beaten because of its backwardness. Its backwardness in military, industrial, cultural and agricultural respects, its backwardness in State administration. It was beaten because this was profitable and could be done without entailing any punishment."

ALL FORMS OF TRANSPORT BACKWARD

Transport in all its phases was no exception in the general backwardness of pre-revolutionary Russia. In 1913 the total length of railway lines amounted to only 2·8 kilometres to each 1,000

sq. km., while in the same year Great Britain had 141·9 km., Germany 117·8 km., and France 95·5 km. of railway lines to every 1,000 sq. km. The total length of railways in Tsarist Russia was only 58,500 km.

The development of inter-regional connections was also far from satisfactory. Communication with Siberia was effected by means of two one-track railway lines, which were joined into one trunk line at Omsk, and further to the east this trunk line had only one track and its construction had never been properly completed. Naturally, the amount of goods conveyed by this line was quite inconsiderable. In 1913 it amounted to only 1·7 million tons on the two one-track lines, and further on, in the direction of Omsk and Novosibirsk, it amounted to only 500,000 tons. The connection with the districts of Kazakstan and Central Asia was also unsatisfactory, being effected by means of one one-track line with a traffic turnover with these vast regions of about one million tons. Railway transport to and from the North Caucasus and Transcaucasia amounted to 1·5 million tons of goods, while the traffic turnover between the Donbas territory and the Petersburg district reached 600,000 tons. There were quite insufficient means of communication with the north of Russia, there being only a solitary railway line, the Archangel railway, which had but one track. There was no connection whatever with the vast territory of North Siberia.

This backwardness of the railways was also shown in their technical equipment. Much of the rolling-stock was very poor and out of date. Most of the engines belonged to the series " O " with a tractive force of less than nine tons. Wagons were of the two-axle box type with insufficient carrying efficiency. Trains were not equipped with automatic brakes or automatic couplings.

Rails were of the light-weight type with a light layer of ballast and a quite insufficient number of sleepers. Means of communication and signalling were of a very primitive character. There was a complete lack of automatic block systems. Tsarist Russia was satisfied with such out-of-date railway transport because its economic development was very low. In 1913 the total freight turnover was only 132 million tons.

The same backwardness was manifested in river transport. The enormous river basins of the Ural and Siberia were not (with a few exceptions) used as means of communication, while the opportunities offered by the European rivers were very insufficiently exploited. The best was the river Volga, the most ancient water route of the country. The transport facilities of the Volga were, however, insufficient in number and out of date as regards technical equipment. There was no connection between the Volga and the Baltic Sea, as the Mariinsky canal system did not meet the requirements of a direct water route to Petersburg. The Dnieper rapids

formed a barrier between the upper and lower part of the river and made normal navigation quite impossible. There was no communication between the Baltic and the White Sea.

The equipment of the river ports as well as seaports was conspicuous for the absence of the most elementary facilities, as well as the absence of any mechanised equipment for loading and unloading.

Everything that was done for water transport in pre-revolutionary times was marked by exceptional stinginess. The Tsar's officials not only showed their inefficiency in the struggle with the elements of nature, but could not even effect the most necessary hydro-technical constructions that were urgently needed for normal navigation and did not require any exorbitant expenditure.

Nothing need be said about air and road motor transport as these means of communication did not exist in Tsarist Russia.

In those parts of the country where there were no railways, there were practically no efficient means of transport ; in a number of vast regions and districts they were limited to country roads which after even moderate rain became impassable, and caused the loss of many horses. In the whole of Russia there were but 24,300 kilometres of highways of an approved type, of which only 4,800 km. were paved.

Such was the condition of the transport system left to the country by Tsarist Russia. The description would not, however, be complete without mentioning

two characteristic features of pre-revolutionary transport. First, a considerable part of the construction of railways and other means of transport in Tsarist Russia was effected with the assistance of foreign capital, which supplied the country with financial resources and materials. For instance, during the first period of railway construction, up to the year 1875, the foreign market participated to the extent of 50 per cent in the joint stock capital of railway companies, and 75 per cent in the railway bonds. In the subsequent period of railway construction the share of foreign capital in loans issued by the Tsarist Government was 52 per cent. Besides, during the period 1838–75, 75 per cent of all the rails laid were imported from abroad. The rolling-stock, particularly engines, as well as steamers for the river and sea routes were also supplied from foreign sources. In this way foreign capital played a most active part in the construction of ways of communication in Tsarist Russia.

Another characteristic feature was that the construction of railways and the development of sea and river routes were made to serve the interests of the foreign trade of Russia. Little consideration was given to the economic development within the country. The establishment of connections with the sea or with the land frontier was the *leit-motif* of all transport construction in the pre-revolutionary period. Railways were extended and river routes developed connecting the interior with the ports of

the Baltic, Black and White Seas, as well as with the Sea of Azov, with the western land frontier and the shore of the Pacific Ocean. It was the chief aim of the Tsarist Government to export to foreign markets the greatest possible amount of agricultural raw material and timber, so that big profits might be realised. This was also the chief object in view in the development of sea routes.

The construction of ways of communication to meet the requirements of the economic development within the country was quite a different matter. The country was kept in the same roadless state ; such ways of communication as existed could not satisfy the requirements of economic development, and this was a hindrance to the development of the productive forces of the country.

TRANSPORT COLLAPSE DURING THE WAR

In order to give a clear idea of the condition in which the transport system was found by the Soviet Government, it is necessary also to mention in what degree it had suffered from the effect of the imperialist war. Besides the limitation of all transport construction as a result of the war, the means of transport owned by the Tsar's Government were in a most unsatisfactory condition. This is clearly shown by a report which Adjutant-General Alexeef, Chief of Staff of the Tsar's army, addressed to Nicholas II in May 1918 :

" At the present time," writes General Alexeef,

" there is hardly a single sphere of State or public life which does not suffer from the serious disturbances resulting from the unsatisfactory state of transport. Transport facilities are placed at the disposal of industrial concerns working for the defence of the country in preference to and to the disadvantage of all other concerns. Nevertheless even Government works holding an exclusive position in preference to others do not receive the fuel, materials and parts required by them, for which orders had been given and filled some time ago, because they cannot be delivered and have to wait for months before they are forwarded. Sometimes ' there are no cars available ' ; another time ' there are cars, but no instructions have been given ' ; sometimes ' the volume of freight exceeds the transport capacity of the railway section in question.'

" At the present rate of production of the Artillery and the Putilov works the supply of fuel and metal will only suffice for a couple of days. General Manikovsky is in vain trying to prevent the stopping of the Lugansk cartridge works, which will be inevitable if it does not receive immediately at least a small part of the oil purchased and awaiting delivery in Baku. The Obukhov works of the Admiralty are also in urgent need of the delivery of fuel and metal. The condition of private concerns in regard to the supply of fuel and material is far worse and has reached a critical stage. On the average, the concerns working for the defence of the country cannot get more than

50–60 per cent of the necessary supplies transported, and the Minister of Ways of Communication recently declared that of the 18·5 million poods required by the Petrograd district, it would be possible to transport only 8 million poods.[1]

"We have inexhaustible natural resources in mineral ores, coal, fluxes, etc., but, instead of increasing the production of metal which is so urgently needed, 17 out of the 62 blast furnaces of the Donetz district have been closed down for the reason that it proved impossible to transport the necessary mineral ore, flux and coal located in the same district, and to secure the required labour—several thousand hands.

"According to the report of General Manikovsky the Ishevsky cartridge works are 'using the last few pounds of imported steel,' and the works producing percussion-caps are unable to obtain the metal required.

"With the transport system in such a condition it is not only impossible to increase the output of the works, but we shall be obliged to limit the present production."

It is evident that the transport system of Tsarist Russia was unable to stand the test of the imperialist war because of its backwardness. This test also proved too much for the economic conditions of Tsarist Russia and the political system of the monarchy, which collapsed in February 1917.

[1] 1 pood = 36·1128 English lbs.; approximately 62 poods = 1 ton.

The destruction of transport did not come to an end when Russia went out of the war. After the November 1917 Revolution the civil war began. The White Guards and the interventionists, having seized a considerable part of the country—Siberia, the Urals, the Ukraine, the north of Russia—continued to destroy the means of transport. When they were pressed by the Red Army and began their retreat, they blew up the most important railway bridges, destroyed stations and railway lines, spoiled the water supply, demolished engines and cars and sank ships of the river and sea fleets, besides seizing a considerable part of the Black Sea fleet. The destruction of transport stopped only after the Red Army had driven the enemy from Soviet territory.

During the civil war the following were destroyed : 4,322 railway bridges with a total span of approximately 90 km., 1,885 km. of main railway tracks, 2,904 switches, and about one million cubic metres of buildings and civil constructions. By the end of the civil war the number of defective engines reached 60 per cent, and that of defective wagons 30 per cent, of the total rolling-stock. Sea transport suffered still more, a substantial part of the fleet having been either sunk or carried off by the retreating armies. On all the seas, with the exception of the Caspian Sea, 83 per cent of the ships and 76 per cent of the total amount of tonnage had been destroyed.

As a result of this destruction the connections

between the most important regions of the country, which had always been weak, broke down altogether. The central industrial regions, the districts of Moscow, Ivanovo and Petrograd, were cut off from the supply of coal from the Donetz district, of cotton from Central Asia, and grain from the Ukraine, North Caucasus and Siberia. The capacity of the railways for goods traffic decreased from 132 million tons in 1913 to 39 million tons in 1920–21 ; the capacity of the river routes decreased by 70 per cent as compared with 1913.

Such was the melancholy inheritance left to the Soviet Union, an inheritance which was paralysing the entire economic life of the country.

CHAPTER III

THE RECONSTRUCTION OF TRANSPORT AFTER THE REVOLUTION

IT IS EVIDENT that the chief task before the country when it emerged from the imperialist and civil wars was to restore in the shortest possible period the productive forces and the economic life of the country. The chief slogan of this period was : Fight for transport, for bread and coal !

At that time Lenin said :

" We must re-establish the balance of agriculture and industry, and in order to achieve this we must have a material basis. What is the material basis for industry and agriculture ? It is rail and water transport."

The fight for transport and food supplies became almost a war slogan. Many efforts were made, much energy, enthusiasm and heroism was displayed in this struggle by the workers of the Soviet republics. As a result of these heroic efforts the country succeeded in restoring in a very short period bridges, engines, cars, what remained of the river and sea

cargo fleets, wharves, ports, roads ; and the restoration of the principal transport lines led to the re-establishment of connections between the vast regions of the country. The connections between the Moscow and Leningrad industrial centres and the regions of Siberia, Kazakstan, Central Asia, the Urals, the North, the Volga district, the Ukraine, the North Caucasus and later Transcaucasia and the Far East were restored and extended. The flow of freight, grain, coal, oil, cotton, etc., was again directed to the industrial centres.

Transport began to increase its capacity in regard to goods and passenger traffic, approaching pre-war figures. In the year 1927 the amount of goods traffic carried by the railways had passed the pre-war level, 81·6 million ton-kilometres against the 65·7 million ton-kilometres carried in Tsarist Russia in 1913.

The most important economic task was therefore fulfilled. However, the pre-war economic basis, which had thus been re-established, was insufficient for the growing requirements of the Soviet Union, because it had very serious defects.

The technical and economic level of transport could not be compared to that of advanced foreign countries. The country had only an inadequate metal industry—the basis of industrialisation ; it did not make any tractors, automobiles, aeroplanes or lathes ; there was no really up-to-date chemical industry, no construction of agricultural machinery

on a large scale. At that time the Soviet Union took the last place in regard to the amount of electrical energy generated, the quantity of oil or coal produced.

Still more backward from a technical and economic point of view was agriculture, where the system of petty producers with a most primitive and primeval technique prevailed. At the same time agriculture is the basis for the development of industry, being the market that consumes the products of industry and supplies raw material and foodstuffs ; it is also the source of export products which in their turn make it possible to import industrial equipment.

The backwardness of agriculture limited the development of industry and created new difficulties for the economic development of the U.S.S.R. The only way to overcome this century-old backwardness was to reorganise agriculture on the basis of widespread collectivised production supplied with up-to-date technical working equipment.

Finally, the fact that industrial concerns were concentrated in a few districts of the European part of the Soviet Union hindered the development of the productive forces of the vast regions of the U.S.S.R. —particularly Siberia, the Far East, Kazakstan and Central Asia—that were rich in natural resources.

For this reason the Soviet Government, after restoring the country's economic conditions, set itself a new and still bolder task : to reconstruct the

entire economic structure by introducing industrialisation, creating an independent basis for the production of the means of production, by establishing a new coal and metallurgical base in the East, two new textile bases in East and Central Asia ; by developing industry and agriculture in the remoter regions, liquidating the former backwardness of agriculture by reorganising it on the basis of concentrated collectivised production and supplying it with tractors, motors, combines and the most perfect and complicated agricultural implements and chemical fertilisers.

This implied the fulfilment of a most difficult task : to transform the U.S.S.R. in a short period of time from a weak agricultural country into a powerful industrial country. In order to achieve this it was necessary to undertake the reconstruction and rationalisation of the entire system of transport of the U.S.S.R. in order to conform with the new economic plan and the new geography of the country. The transport had to be raised to a level that would meet the requirements of a powerful industrial country.

As is well known, the first five-year plan for the reconstruction of the national economy of the U.S.S.R. was successfully completed in four years and a half. During this period of reconstruction most substantial changes were made in the condition of the transport system of the U.S.S.R., in regard to quantity as well as quality.

RAILWAY TRANSPORT

According to the first five-year plan the transport of goods by the railways for the year 1933 was estimated at 162,700 million ton-kilometres. On the eve of the five-year period, in 1928, the total of goods traffic on the railways reached 93,400 million ton-km. In 1913 it amounted to 65,700 million ton-km. Consequently, the Soviet railways were expected to increase their capacity in the course of five years by a greater amount than the total reached by Tsarist Russia in the course of many years. This was indeed an immense task.

By means of the most intensive work the five-year plan of railway transport was fulfilled in four years. As early as 1932 the capacity of the railways reached the level of 169,300 million ton-km., which exceeded the figure estimated for the fifth year by 4·1 per cent. A still greater success was achieved with the transport of passengers. In 1913 the figure reached was 25,200 million passenger-kilometres, in 1928, 24,500 million passenger-km., and in 1932 it actually rose to 84,100 million passenger-km., while according to the first five-year plan it had been planned to reach only 35,400 million passenger-km.

This over-fulfilment of the transport plan was the result of the entire realisation of the economic five-year plan in four and a half years. The great excess in the number of passengers carried was due to the economic development of the country, the

improvement of the cultural and material living conditions of the working class, the growth of health resorts, and the increased building of suburban dwellings, creating an increase of suburban traffic.

However, the transport plan was fulfilled not only in regard to quantity, but also in regard to quality ; the statistics showed a marked change in the structure and direction of the flow of traffic, which was greatly influenced by the fact that Russia was being changed from an agricultural country into an industrial one. This was particularly manifested in the enormous increase in materials transported for heavy industry, especially for such branches as fuel, minerals, metallurgy and machine building, which is clearly shown by the following table :

TRAFFIC TURNOVER

(in million tons)

Kind of Goods	*1913*	*1928*	*1932*	*1932 in percentages of 1913*
Total turnover including :	132·4	156·2	267·9	202·3
Grain	13·8	16·5	23·8	172·5
Coal	19·9	30·4	56·7	285
Mineral ore	6·7	7·0	12·7	190
Metals	—	5·8	9·5	—
Oil and oil products	4·4	8·7	17·0	386
Timber and firewood	15·7	30·2	46·3	295

New articles appeared on the railways, that had been unknown to Tsarist Russia, viz. tractors, automobiles, combines, chemical fertilisers and many other goods. In 1913 the principal articles of heavy

industry transported—such as coal, mineral ore, oil, metal and metal articles, building material of mineral origin, and timber—amounted to 39·7 per cent of the total turnover ; in 1926 they rose to 40 per cent, and in 1932 they formed 57·1 of the total amount of goods carried. Thus an industrial country has an industrial goods traffic.

A change is also to be noted in regard to the distribution of traffic in the various regions. The creation of new industrial centres, the development of previously backward agricultural districts, the industrialisation of the national republics—all this changed the proportion of traffic in the distant regions to the total traffic turnover. This is shown by the following table :

Various Regions	*Part played by each in the despatch of goods (in percentages of total)*	
	1913	*1932*
Northern district	0·3	1·6
The Ural	4·6	6·8
Kazakstan	0·7	1·6
Western Siberia	1·4	4·5
The Far East	1·1	2·0
Central Asia	1·6	1·9
Total for 6 regions	9·7	18·4

The growing share of the newly developed regions in the total traffic of the railways is clearly shown, and reflects the policy of the Soviet Government in regard to the development of new regions and national republics.

Lastly, the third change in the transport work of the railways is the growth of inter-regional transport, together with a considerable concentration of freight on the principal trunk lines connecting the main producing and consuming regions. This was particularly the case with such main lines as connected the Krivoi Rog mineral district and the coal-mining industry of the Donbas with the metallurgical region of the south ; the Donetz region with the Moscow and Leningrad districts ; the centre of the U.S.S.R. with the Urals and Siberia ; the centre of the U.S.S.R. with Central Asia and Transcaucasia. The growth of inter-regional connections led also to a greater extension of the hauls. For instance, in 1913 the average goods haul was 496 kilometres, while in 1932 it reached 632 kilometres. Consequently the total volume of transport has greatly increased, not only because the quantity of goods to be transported is steadily increasing, but also because these goods have to be carried much greater distances.

The following means were used to enable the railways to achieve this object. First, more adequate connections and greater co-operation with other ways of communication, in the first instance with river transport ; secondly, the mobilisation and rational utilisation of all railway resources ; and thirdly, a considerable increase and reconstruction of all means of transport.

The co-ordination of the railway work with that

of all other forms of transport was obtained by working in accordance with a plan for transport in general, particularly at the junctions. A proper distribution of the traffic, an efficient organisation of the seaports, the auxiliary railways, connections between the railway and motor routes, and the transfer of goods from one form of transport to the other—all this greatly assisted the successful functioning of the railways.

In regard to the mobilisation of internal resources and the rational utilisation of the means of transport, the work performed consisted in eliminating the transport of the same goods in both directions, in avoiding the despatching of empty cars, in increasing the speed of the runs, in expediting the interchange of rolling-stock, in the rational utilisation of the entire rolling-stock and in the correct distribution of the traffic.

These measures resulted in raising the economic and technical standard of operation. For instance, in the year 1913 the average run per day of a passenger train engine was 101 kilometres, whereas in 1932 the average daily run of a goods train engine was 146 km., and that of a passenger train 223 km. ; in 1913 the average run of a goods wagon was 67·8 km., while in 1932 it amounted to 97·3 km. In 1913 an average goods train consisted of 80 axles, in 1932 this had been increased to 104 axles. In 1913 the weight of a goods train averaged about 700 tons, whereas in 1932 it rose to 967 tons. In 1913 the

annual load per kilometre was 1,122,000 tons. In 1932 this load rose to 2,003,000 tons.

In consequence of this intensified exploitation of transport, each engine and each wagon carried more goods in 1932 than in 1913, and even more than had been estimated in the plan for the first five-year period. For instance, according to that plan the average dynamic load per freight train axle for the year 1933 had been estimated at 4·85 tons. By 1932 it had reached 5·3 tons ; instead of the 828,000 ton-kilometres for each ton of tractive force of the engine, estimated in the plan, 866,000 ton-km. were effected ; and instead of the planned 15,500 ton-km. per ton of carrying power of a goods wagon per annum, 16,700 ton-km. had been reached. In this way a more rational utilisation of the means of transport and its natural resources resulted in the successful realisation of the transport plan.

Lastly, considerable work had been done in regard to the extension and reconstruction of all railway transport. In the first place we must note the increased construction of new railways and the extension of the railways under exploitation. As has been mentioned before, the length of railways under exploitation in 1913 amounted to 58,500 km. In 1928 it had increased to 76,900 km. In the course of the first five-year period, 6,500 km. of new lines had been constructed and handed over for exploitation. Consequently, on January 1, 1933, the length of railways under exploitation had reached 83,400 km.

Among the newly constructed railways there stands out a most important main line, the Turkestan-Siberian railway, measuring 1,442 km. and connecting Central Asia with Western Siberia. It is of great economic importance. Another newly constructed main line is the Borovoye-Akmolinsk-Karaganda railway, which furthers the development of the Karaganda coal district, with a view to supplying coal from this mining district to the industries of the South Urals, Bashkiria and Kazakstan. The Leninsk-Novosibirsk railway will be the means of conveying coal from the Kuznetsk district, located in Western Siberia, to the Urals region. The supply of Leningrad with coal from the Donetz will be considerably improved by the newly completed line Briansk-Viasma. Work is going on at full speed on the construction of an important main line that will connect Moscow with the Donbas.

Besides new construction, extensive work has been carried out for the purpose of reconstructing or raising the capacity of existing railways. A second track has been laid on the Siberian railway ; the gradients on the line have been adjusted, and a new line connecting Siberia with the Urals *via* Kurgan has been constructed. Second tracks have been laid on the Ekaterinsky railway, which connects the Krivoi Rog district with the Donbas, and also on the main lines connecting the Donbas with the central regions of the U.S.S.R. Important railway junctions, such as the stations Yasinovataya and Krasny

Liman in the Donbas, have been reconstructed, and a station for sorting mineral ore has been built on the outskirts of the Krivoi Rog mining district. New railway junctions have been built at Magnitogorsk, Kuznetsk and Karaganda. In the course of the four years of the five-year period the railways have received 2,660 new goods engines, and 288 passenger engines. The construction of a new series of powerful goods engines ("FD") and passenger engines ("JS") is well under way. During the five-year period the total tractive force of the engines has increased by 35 per cent. Considerable work has been done in connection with the installation of automatic block systems on the most congested lines. The suburban railways of Moscow, Leningrad and Baku have been electrified, electric goods transport has also been established on the Suram pass, and similar work has been almost completed in the Urals. The first results of the exploitation of the electrified Suram pass, over which a considerable amount of oil is transported from Baku to Batum, have clearly proved the advantages of electric traction. Formerly, on the steepest incline of the Suram pass, one engine could draw a goods train of 250 tons in weight at a speed of 10–12 km. per hour ; now, after electrification of the line, one engine draws a train weighing 500 tons at a speed of 28–30 km. per hour. The transporting capacity of this line has been doubled, and instead of the former 38–40 engines 12–15 electric engines have been found sufficient, one

electric engine doing the work of three steam engines.

In the course of the five-year period the number of passenger coaches and goods wagons was increased. Many of these were equipped with automatic brakes and air pipes. A considerable increase is also to be noted in the number of special large-capacity four-axle cars, tank cars, special cars for transporting ore and coal, isothermic cars, etc. The average carrying power of the rolling-stock has also grown. Operations that formerly involved considerable manual labour are now being mechanised. Mechanisation of the loading and unloading operations, which was almost unknown before the Revolution, was effected in 1932 to the extent of 18·3 per cent of all such operations. Of course, this rate of mechanisation is considered far from satisfactory, and the work of mechanisation is being pressed forward.

Lastly—and this is of special importance for railway transport—a marked extension is to be noted in the operations of the works supplying railway equipment. The building of new metallurgical works and the reconstruction of the old ones has greatly increased the capacity of the works producing rails of an improved type, which are urgently needed for transport. The railway engine- and carriage-building works have also been reconstructed and enlarged. The construction of large new works in Lugansk for the building of powerful engines is nearing completion ; a part of the new works began to function

in October 1933. There are other engine- and wagon-building works under construction, among which may be mentioned a big wagon-building works in the Urals, the construction of which is being pushed forward. Electric locomotives are being built for the first time in the U.S.S.R. at the Dynamo works in Moscow, while a large new factory for the building of electric locomotives is being erected in Kashira. Work has been started on part of a big factory in Moscow which will supply spare parts for railway repair workshops.

All these measures have resulted in a considerable increase in the available supplies of railway equipment, which in turn increases the capacity of the railways, assisting them in the successful achievement of the transport plan.

According to the second five-year plan the goods traffic of the railways is to reach 300,000 million ton-kilometres in 1937, as compared with 169,000 million ton-km. in 1932.

In the course of the second five-year plan 11,000 km. of new railway lines are to be built and handed over for exploitation. In this are included the Moscow-Donbas line, for the transport of coal from the Donbas to the central regions ; the Akmolinsk-Kartaly railway, for the transport of Karaganda coal to the Urals ; the Karaganda-Balkhash railway, which is being built with a view to the development of industry in the region of Lake Balkhash ; the Ufa-Magnitnaya railway, for transporting the

products of the Magnitogorsk Combine works to the western districts ; the Baikal-Amur railway, which will connect Transbaikalia with the lower part of the river Amur, passing through a region the greater part of which has hitherto been almost inaccessible.

Along with the building of new railways the existing lines will be reconstructed with a view to increasing their transport capacity and extending the connections between and within the various regions. The principal items of this reconstruction in the second five-year period will be the following : the electrification of 5,000 km. of railways, the laying of 9,500 km. of doubled tracks on main lines, principally in the eastern part of the U.S.S.R. ; the extension of shunting yard tracks by 8,500 km. ; the reconstruction of railway lines covering 20,000 km. and the installation of automatic block-systems on 8,300 km. During the period 1932–37 the number of goods train engines will be increased from 16,350 to 19,720, or by 26·2 per cent, while their capacity will be increased by 51·8 per cent by the construction of powerful goods train engines of the series " FD," 400 electric locomotives, and 270 internal-combustion engines. The capacity of passenger-train engines will be increased by 54·2 per cent by constructing new powerful engines of the type " JS." The number of goods wagons will be increased during this period from 507,900 to 645,000, or by 27 per cent, while their carrying power will be increased by 66·3 per cent by the construction of large-capacity four-axle

cars. The entire rolling-stock will be equipped with automatic brakes, and a considerable part of it with automatic coupling.

Scientific research work and new inventions have played a very important part in the reconstruction of railway transport. Scientific institutes have been organised for research work in regard to traction, railway tracks, electrification, signalling, efficient exploitation, supply of materials, establishing standards of labour, railway construction work and labour.

The task set before the institutes of scientific research is to solve the problem of the technical development of each individual branch of railway transport. This research work is not limited to the institutes ; a great number of engineers, technicians and workers participate in it, assisting with their inventions in the work of reconstruction.

As a result of this scientific research work important results have been achieved. In regard to the construction of engines, two new types of engines have been worked out as being the most suitable for the railways of the U.S.S.R. : one for goods trains, the type " Felix Dzerzhinski " (" FD 1–5–1 ") with an axle load of 20 tons and a capacity almost one and a half times greater than that of the existing engines of the series " E." The tests made with the engines " FD " have proved their high working efficiency, which is not inferior to that of powerful American engines. The building of such engines is well on its way at the new Lugansk engine works.

For passenger trains the accepted type of engine is the "Joseph Stalin" type ("JS 1–4–2"), which exceeds by one and a half times the capacity and speed of the most powerful passenger engine, type "SU," that has hitherto been used on the U.S.S.R. railways. This type of engine is now also being built in considerable numbers.

The achievements of scientific-technical work have also been adopted in the construction of a new type of internal-combustion engine (2–5–1) with an axle-load of 18·5 tons and a tractive force of 22 tons. This new engine is being built at the Kolomensky works. Two types of powerful electric locomotives have also been constructed for goods as well as for passenger trains and are already working on the Suram pass.

Soviet transport has designed and constructed its own type of automatic brakes—the brakes of Kazantzeff and Matrosoff. At an international competition the automatic brake of Matrosoff won the first prize, and it is now being produced in Soviet factories. An automatic coupling has also been selected that has proved the most suitable for the rolling-stock of Soviet transport.

With the assistance of Soviet designers and scientific research institutes Soviet industry has succeeded in turning out four-axle wagons of great capacity, open wagons, tip-up wagons, tank-wagons, etc.

In regard to rails, the efforts of the designers and scientific research institutions have been directed

towards increasing their strength and producing medium-manganese, chrome nickel, chrome-vanadium and other rails of high quality.

Very interesting and original propositions have been made lately with a view to creating super-speed means of transport. The author of one of these projects is engineer M. Yarmolchuk, who recently graduated from the Institute for Transport Engineers. His project shows a most original construction, the car having the shape of a dirigible, the wheels being replaced by spheres, and the rails by a groove. The car, driven by electricity, rests on two spheres and moves along a special groove on the principle of the single-track motion of a bicycle. In this electro-sphere-groove system the metal sphere replacing the wheel is hollow with the segments at the sides cut off; it is welded and coated with vulcanised rubber. In the centre of the sphere is a stationary hollow axle, on the ends of which the car is suspended. A motor is rigidly fixed to the inside of the axle, and through its rollers it rotates the sphere. Each car has two spheres placed one behind the other, which gives the car a free single-track motion. The car is in perfect equilibrium and the spheres are stable owing to a low centre of gravity. The speed of the car, which holds 110 passengers, can reach from 200 to 300 kilometres per hour according to the diameter of the sphere. Freight cars have a carrying power up to 30 tons. Several such cars make up a train.

Engineer Yarmolchuk has been working at his system of super-speed transport since the year 1924. The first model for testing purposes was constructed by him in 1929 at 1/25th of its full size. In April 1932 five cars were constructed, the dimensions of which were 1/5th of their full size ; they were 6·24 metres long, the diameter of the sphere was 75 cm. and they were equipped with 1·5 h.p. motors. The groove was covered with steel with a coating of vulcanised rubber. The technical and economic estimates as well as practical tests proved the great economic efficiency of this system.

Consequently the Council of People's Commissaries of the U.S.S.R. passed a decision on August 15, 1933, to start the construction of a trial line of 20–25 kilometres in length of medium clearance gauges for the exploitation of the Yarmolchuk system. This line, which will run from Moscow to Noginsk, has been supplied with the necessary materials and finances and will be completed in a short time.

RIVER TRANSPORT

Compared with other countries the territory of the U.S.S.R. abounds in waterways, which reach a total length of 421,000 km. Among these are huge water arteries with large tributaries which are not inferior to the largest waterways of the world. The most important rivers are the Lena, with a length of 5,300 km. ; the Yenisei, 4,750 km. ; the Irtysh,

4,150 km. ; the Volga, 3,750 km., and together with its tributary the Kama, 5,750 km. ; the Obi, 3,700 km. ; the Amur, 2,900 km. ; the Ural, 2,500 km. ; the Dnieper, 2,250 km. ; the Don, 2,000 km.

Besides the rivers there are many vast lakes which are very convenient for the development of navigation. The largest of these are Lake Baikal, with an area of 34,000 sq. km. ; Lake Ladoga, 18,000 sq. km. ; Lake Balkhash, 18,500 sq. km. ; and Lake Onega, 9,800 sq. km.

Most of the navigable rivers approach each other at some point in their course, which makes it possible to establish an artificial communication between them. They flow into ten different seas, the majority of which are navigable.

However, Tsarist Russia made very little use of this wealth of water. A striking proof of this statement is the river Volga, which at that time was the best exploited river of the country. In the year 1913 the water-borne traffic on this river together with its large tributary the Kama, serving a population of 45,000,000, was only 23·4 million tons including rafts, while the turnover on the Rhine, with a length of only 700 km., reached 43 million tons in 1913. The total of cargoes carried by the Rhine was almost equal to the total cargoes transported by all the waterways of Tsarist Russia.

Owing to the development of the national economy of the Soviet Union, particularly in the regions

lying within reach of navigable rivers, there is now a marked growth in the amount of goods transported by river. For instance, in 1923 the turnover of river transport amounted to only 20 million tons, against 48 million tons transported in 1913 ; in 1926 it had grown to 33 million tons ; in 1928—i.e. on the eve of the five-year period—it had reached nearly 40 million tons, and in 1929 it exceeded the pre-war level and reached the figure of 50·8 million tons. From this time the increase continued at a still more rapid rate and in 1933 the traffic greatly exceeded the pre-war level, reaching 72 million tons. In the first year of the second five-year period river transport thus exceeded the pre-war figure by 50 per cent.

The transport of passengers by river showed a still greater increase :

1913	11·2	million	people
1923	8·9	,,	,,
1928	20·0	,,	,,
1932	48·5	,,	,,

In 1924 the number of passengers carried exceeded that of the pre-war period, and in 1932 the number of passengers carried was 333 per cent greater than in 1913. This was the result of the general economic development of the country and of the growth of the material prosperity and cultural level of the workers.

In regard to the kind of goods transported by inland waterways, there is, as in the case of the railways, a marked change brought about by the industrialisation of the country ; the volume of traffic of

the products of heavy industry has greatly increased.

The development of the productive forces of the more remote regions, particularly in the east, has considerably increased the transport on these river basins. For example, during the period 1928–32 the entire goods turnover of river transport increased by 81 per cent, while the cargo turnover of the northern river basins, including the Northern Dvina and Pechora, rose 455·6 per cent, that of the Siberian rivers, including the Obi, Yenisei, Irtysh and Lena increased by 226·3 per cent, that of the Amur, in the Far East, by 200 per cent, and lastly the goods transported by the rivers of Central Asia and Lake Balkhash increased by 1,000 per cent.

The successful handling of this increased amount of work was due to the reconstruction and rationalisation of the means of river transport.

A striking instance of the considerable improvement in the exploitation of the fleet is the growing efficiency per indicated horse-power and per ton of carrying power. For instance, in 1913 the cargo carried per indicated horse-power of the self-propelled fleet was 35·2 tons ; in 1929 it rose to 67·3 tons, and at the present time it has reached about 100 tons. In 1913 the load on each ton of carrying power of non-self-propelled vessels (barges, rafts, etc.) was 2·5 tons ; in 1929 this load was 7·3 tons, and at the present time it has reached 10 tons. Consequently there is a greatly intensified exploitation of the river fleet, which has been

attained by means of a correct planning system and the rational use of the means of transport. The latter have also grown in number as a result of the extension of navigable waterways. In 1929 the total length of navigable water routes was 74,000 kilometres, while in 1933 it had risen to 85,000 km. This is due to the construction of the White Sea–Baltic Canal, the establishment of direct through traffic on the Dnieper after doing away with the rapids, and the introduction of navigation on the Siberian rivers Hatanga, Indigirka and Kolyma.

Together with increasing the length of navigable waterways much work has been done to improve them. In 1933 about 49,000 kilometres of river routes were equipped for night traffic. Dredging was carried out on rivers to a total length of 30,400 km. These facts indicate to what extent the conditions of river navigation have been improved during the last few years.

Considerable additions were made to the river transport equipment during the first five-year period and in 1933. Taking the number of steamships available in 1928 as 100, their number had increased by 1933 to 174, and that of the non-self-propelling vessels to 189. A characteristic feature of this growth is that it was not only shown in the quantity of the ships, but also in their quality. The new ships are more up to date, with greater capacity and greater carrying power, and they can develop a much greater speed.

Considerable success was obtained in the creation of industrial bases for the commercial fleet by means of reconstruction and re-equipment of old wharves and the construction of big new shipbuilding works. The repair shops, the yards for building wooden vessels and the principal river ports were supplied with new equipment. The mechanisation of the loading and unloading work was undertaken, a vast network of storehouses, refrigerators and elevators was established, and a forwarding service was for the first time introduced in river transport. However, it must be frankly admitted that all the work performed has not been sufficient to meet the requirements of the developing economy of the country. For this reason it has been decided to continue the work of developing and reconstructing river transport during the second five-year period, i.e. in 1933–37. To meet the requirements of the national economy of the country the amount of goods transported along the rivers in 1937 must reach 90 million tons against 47 million tons transported by ships and barges in 1932.

The intense growth of the demand for transport necessitates the addition of 17,000 kilometres of navigable waterways. This requires hydro-technical work on a very large scale. After the completion of the White Sea–Baltic Canal, the Volga–Moscow Canal, with a length of 127 km., must be built and handed over for exploitation, which will once for all solve the problem of the water supply of the city of Moscow ; construction will be started on the

Volga–Don Canal, 100 km. long, which will connect the Volga with the Black Sea, while the Mariinsky and the Moskvoretsky water systems will be reconstructed, and a number of rivers in the north, in Siberia and the Far East will be included in the transport system.

Along with the extension of navigable waterways the reconstruction of the principal river ports will be continued, including all the work required for this purpose. But the chief item in the second five-year plan for river transport is the construction of a new merchant fleet and the increase in the number of ships of a better type.

TRANSPORT BY SEA

The territory of the Soviet Union is surrounded by a number of seas. The total length of the boundaries of the U.S.S.R. is 60,000 kilometres, of which 75 per cent is sea coastline. However, until recently a substantial part of the coastline, that of the Arctic Ocean, was not made use of, and therefore had no great importance from the point of view of transport, for which the most important seas are the Caspian Sea, the Black Sea, the Sea of Azov, the Baltic Sea and the Sea of Japan. During the last decade, particularly in the course of the first five-year period, there has been a marked development of the productive forces of the regions along the sea-coast. The growth of industry, agriculture, forestry and the general development of the national economy of

regions adjoining the sea-coast has created the problem of developing the sea routes, finding new ways of communication, building ports and organising a powerful merchant service. From year to year new ships have been added to strengthen the sea transport system, the greatest increase in this connection having taken place during the first five-year period. Taking the carrying capacity of the mercantile marine in 1929 as 100, it had reached 213 in 1932, and had risen to 250 in 1933.

The growth of the carrying capacity of the mercantile marine is not only the result of an increased number of ships, but each ship had increased its carrying power. For instance, in 1929 the average carrying capacity per steamer was 1,510 tons ; by 1931 it had risen to 1,890 tons, and by 1933 it had already reached 2,250 tons. Almost one-third of the existing fleet began to operate in the course of the last five years, during which period considerable renewals and additions have been made.

Together with the growth of the merchant marine we may note the increase in the quantity of the goods shipped by sea. This is clearly seen from the following table :

Years	*Amount of cargoes shipped by sea (tons)*
1913	33,069,000
1924	10,118,000
1928	18,416,000
1932	34,349,000

As the table shows, the greatest increase has taken place during the last few years. This is directly connected with the growth of the sea-going fleet during those years, although it has required a longer period of time to restore the capacity of sea transport than in the case of any other kind of transport. In 1932 sea transport exceeded the pre-war level by only 3·9 per cent, while railway transport showed an excess of 157·7 per cent, and river transport 38 per cent.

There is also a marked change in the kind of goods transported as compared with the pre-war period, showing a great increase of industrial cargoes.

CARGO TRANSPORT BY SEA

(in thousands of tons)

Class of Cargo	*1913*	*1932*	*1932, in percentages of 1913*
Total carried including :	33,069	34,349	103·9
Timber	4,095	5,923	144·6
Oil	6,148	15,738	256
Metals	533	1,082	203
Machinery, implements and parts of same	68	449	660·3

The greatest increase is in the transport of machinery, metals and oil products, which is the result of the fact that the U.S.S.R. has changed from an agricultural country into an industrial one.

The sea transport of the U.S.S.R. consists of three types : the coasting trade within the limits of each

sea, shipments from one sea to another, and lastly transport connected with the foreign trade of the U.S.S.R. The coasting service is most important in the Caspian Sea, where the transport of oil is concentrated on a big scale. The Caspian fleet has to convey oil products to Astrakhan, whence they are shipped to the north along the Volga and re-shipped in various directions. Oil and oil products are also transported between Baku and Mahach-Kala, where they are transferred to the railway to be conveyed to the interior regions of the country.

The second place in the coasting trade belongs to the Black Sea and the Sea of Azov, where the freight transported includes oil, grain, coal, ore, cement, sugar, salt, etc. In the other seas of the U.S.S.R. the transport along the coasts is less considerable.

The shipments from one sea to another are concentrated in two principal directions : firstly, between the Black and the Baltic Seas, chiefly for the purpose of supplying Leningrad with oil and oil products, the return freight consisting mostly of machinery and tools ; and secondly, between the Black Sea and Vladivostok, for shipping oil, salt, grain, cement, etc., to the Far East. Recently a third sea route has been used, through the Arctic Ocean from Archangel to Vladivostok.

Nearly all the seas of the U.S.S.R. participate in export and import shipments, the greatest share belonging to the Black Sea, the Baltic Sea and the White Sea.

Sea transport—as well as the other sections of transport—has fulfilled the plan of the first five-year period. The amount of freight carried has increased, the number of ships has grown, and the shipments made in Soviet ships have greatly increased ; considerable work has been done in regard to the organisation of ports and the mechanisation of loading and unloading work.

The most interesting achievements in the extension of sea transport are the construction of the White Sea–Baltic Canal, which connects the Baltic Sea with the White Sea, and the work done towards the establishment of a direct northern sea route from the west to the east through the Arctic Ocean.

During the last few years shipbuilding has been placed on a solid industrial basis, and in the course of the second five-year period will supply the sea transport system with vessels of special types, such as ships with refrigerator equipment, special vessels for carrying timber, ice-breakers, tanks, etc., in which the latest internal-combustion engines and improved types of steam engines and motors will be used.

In the course of the second five-year period the work of the sea transport system will be increased almost three times. During the period 1932–37 the ton-kilometres of cargoes carried by the Soviet sea fleet will be increased from 18,000 million to 51,000 million ton-kilometres.

Along with the reconstruction and extension of

the fleet during the second five-year period preliminary work has been started for the construction of a Volga-Don Canal. In the second five-year period a regular freight and passenger service will be established between the northern territories of the Soviet Union and the Far East.

In regard to the development of ports, the second five-year plan provides for the continuation of the work begun during the first five-year period on the construction of ports at the estuary of the river Pechora, in the village of Soroka, situated at the outlet of the Baltic–White Sea Canal, as well as at Murmansk, Kherson and Baku.

The reorganisation of the ports will have for its object the extension of mooring facilities, the mechanisation of the loading process, the development of storage, the improvement of conditions for the exploitation of ships and the cultural requirements of the passengers.

The output of shipyards in 1932 was three and a half times that of 1927–28. The maritime shipyards during the four years of the first five-year plan produced 86 commercial ships with a capacity of from 1,000 tons (fishing trawlers) to 18,700 tons (tankers). Pre-revolutionary shipbuilding, in spite of all the privileges granted by the Tsarist Government, laid down the keels of only nine commercial ships, with a total capacity of 3,800 tons, during a period of thirteen years. The tonnage of ships built during the first five-year plan was over 200,000 tons and

exceeded eight times the tonnage of all ships built in Tsarist Russia in thirteen years.

New types of Soviet ships have been created : two types of motor-driven refrigerating vessels with a capacity of 2,400 and 3,200 tons respectively, motor passenger vessels carrying 550 passengers, tankers with a capacity of 7,500 and 10,000 tons, cargo ships of 6,500 tons, timber-carrying ships of 5,500 tons.

The building of the hulls of large vessels, which formerly occupied from ten to eighteen months, has been reduced to from six to seven months, and three months for trawlers. The introduction of internal-combustion engines made it possible to shorten the time of completion on the water to from two to three months, whereas it formerly often took no less than two and a half years. Electric welding is being largely used, quickening and cheapening ship-building.

Considerable improvements and extensions of shipping facilities were made in the ports during the first five-year plan. Fourteen docks were reorganised in Archangel ; new wharves near the lumber-mills, new warehouses and a coal basin were constructed ; channels were deepened and the docks generally improved.

Since 1932 work on the construction of Pechora port has been in full swing.

In Leningrad, a mechanised harbour with eight docks for deep draft vessels was built on a low lying island ; a pier for loading timber has been built,

and the storage capacity has been increased by means of new iron and concrete warehouses. The port of Leningrad has been technically equipped and brought up to date.

A number of ports, such as Kherson, Novosibirsk, Batum, Baku, Mariupol and Vladivostok, have undergone a radical reorganisation and mechanisation. The port of Murmansk has been completely reorganised.

The second five-year period will raise Soviet sea transport to a higher stage of development to meet the requirements of the country's economy.

TRANSPORT BY AIR

Transport by air did not exist in Tsarist Russia. The Soviet Union created this form of transport, and has successfully developed it.

The first air line began to function in the summer of 1922 ; this was the Moscow–Kovno–Koenigsberg line, organised by the Soviet-German United Company for Air Transport, the " Deruluft." Later this line was extended to Berlin, and new air lines were established between Leningrad and Riga and Leningrad and Berlin.

In 1923 an extensive campaign was started among the workers of all the republics of the Union with the object of establishing independent air lines, creating Soviet aviation. Associations like " Dobrolet," " Ukraine Air Transport," " Transcaucasian

Aviation," and the " Friends of the Air Fleet " were organised at that time. The first Soviet air lines were established, using at first foreign aeroplanes. These lines covered the European part of the U.S.S.R., Transcaucasia and Central Asia. They were generally welcomed, and were at once placed on a sound basis, particularly the line of Moscow–Kharkov–Rostov–Baku, which connected the centre of the U.S.S.R. with the centre of the Ukraine, Northern Caucasus and Transcaucasia, as also the lines of Central Asia. In 1924 " Transcaucasian Aviation " was incorporated with " Ukraine Air Transport," and this line covered the whole territory of the Ukraine, North Caucasus and the Transcaucasian Federated Soviet Republic. The " Ukraine Air Transport " and the " Dobrolet " also started survey work from aeroplanes.

During the following years the network of air lines grew very rapidly in the U.S.S.R., as can be seen from the table given below.

THE AIRLINES OF U.S.S.R.

1922	1,200 kilometres
1923	1,666 ,,
1924	5,248 ,,
1926	6,660 ,,
1928	11,442 ,,
1932	32,000 ,,
1933	37,000 ,,

At the present time a number of main air lines have established inter-regional connections within

the U.S.S.R. Such are: (1) the line Moscow–Kharkov–Rostov–Mineral Springs–Baku–Tiflis; (2) the line Moscow–Samara–Orenburg–Tashkent; (3) Moscow–Kazan–Magnitogorsk–Karaganda–Alma-Ata, which passes through the Tartar Republic, the very important Magnitogorsk metallurgical centre, the Karaganda coalfields and Alma-Ata, located near the centre of Kazakstan; and (4) the longest main line connecting Moscow with the Urals, Siberia and the Far East, i.e. the line Moscow–Sverdlovsk–Novosibirsk–Irkutsk–Khabarovsk–Vladivostok.

Besides these main air lines for inter-regional communication there are other main lines of minor length, viz. Leningrad–Moscow, Moscow–Minsk, Archangel–Siktyvkar (the centre of the Komi district), Moscow–Stalingrad, Kharkov–Odessa, Moscow–Kiev, Omsk–Semipalatinsk–Alma-Ata–Tashkent, an air line leading to Yakutsk, and others. There are also air lines of local character for communication within the districts.

In regard to the development of the Soviet air fleet the most characteristic feature is the construction of Soviet air craft. In the beginning transport by air was effected by means of aeroplanes which the Soviet Government purchased abroad. In the course of the first five-year period the Soviet Union created its own aviation industry, and at the present time it produces aeroplanes with many motors of the new type "Ant-14" for a score of passengers, all-steel

aeroplanes "Steel-2," one-motor great speed planes, and many motor mail planes, planes for carrying freight, hydroplanes and dirigibles.

The first attempts in the field of dirigible building were made in 1920–25. Out of the scrap of old airships and aeroplane parts the first dirigibles of a small cubic capacity were built. They were "The Red Star" in 1920, "October VI" (170 cubic metres) in 1923, and "Khemik-Rezinchik" (2,400 cubic metres) in 1925.

The serious construction of airships began only during the first five-year plan. Dirigible building immediately attracted the attention of the working masses, and large sums were collected for the construction of the first airship. The workers of Moscow and other industrial centres were initiators in the movement to secure Soviet-made airships. The newspaper *Pravda* backed the initiative of the Moscow workers and in a short time twenty-seven million rubles were collected by means of voluntary donations. In 1930 the students of the Moscow Aviation Institute, together with the workers of the Kauchuk (rubber) factory contributed the envelope for a dirigible.

In August 1930 a dirigible with a capacity of 2,500 cubic metres, the "Komsomolskaya Pravda," was built.

In the first half of 1932 three new dirigibles were built: B-1 (2,200 cu. m.), B-2 (5,000 cu. m.), and B-3 (6,800 cu. m.). All these dirigibles were

of the so-called " soft " type. At the end of the first five-year plan the production of semi-rigid airships began, and on May 1, 1933, the first Soviet semi-rigid dirigible B-5, with a cubic capacity of 2,150 cu. m., was completed. In the summer of 1933 the design for the first semi-rigid dirigible in the U.S.S.R. with a cubic capacity of 18,500 cu. m. was completed, and construction was begun. Simultaneously, the construction of a high-speed semi-rigid airship of 9,150 cu. m. was begun. In November 1933 some young Soviet specialists completed the design for the first airship with a cubic capacity of 50,000 cubic metres. At present the problem of a metal-framed airship is being solved. In 1936 the air fleet of the U.S.S.R. will receive the first metal framed airship with a cubic capacity of 8,000 metres.

As examples of the usefulness of airships, we may point to airship B-3, which flew from Moscow to Kharkov-Slavyansk and back, and from Moscow to Kazan and back ; airship B-1 flew from Slavyansk to Sebastopol and then on to Moscow. It also made a number of trips over the Black Sea.

The flights of 1933 showed the complete practical possibility of using the airships for passenger and cargo traffic.

The air fleet has a staff of splendid workers famous not only in their own country, but also abroad, such as engineer Tupoleff, the constructor of the all-steel planes, aviators like Babushkin, Vodopianov, A.

Liapidevsky, S. Levanevsky, Petroff, Slepnev, Galysheff, Doronin, H. Kamanin and V. Molokov, who have made a number of heroic flights, some of them under most difficult conditions in the Arctic regions. They have all received high rewards from the Soviet Government, and the aviators Liapidevsky, Levanevsky, Slepnev, Doronin, Kamanin and Molokov bear the title of " heroes of the Soviet Union " for their splendid work in the rescuing of the members of the *Cheliushkin* expedition.

The struggle for the establishment of a strong civil air transport system with the object of increasing inter-regional connections, particularly with the distant regions of the Soviet Union, is illustrated by the following figures showing the great increase in the work performed by Soviet aeroplanes :

TRANSPORT BY AIR

Years	*Passengers*	*Transported Freight and mail in tons*
1922	276	13
1925	6,106	85
1928	10,613	255
1930	14,875	340
1932	31,600	1,006
1933	42,500	3,456

According to the second five-year plan the length of the air lines of All-Union importance will reach 85,000 kilometres in 1937. It has also been planned to establish local air lines, the length to be exploited to reach 35,000 km. in 1937. The part played and

the place taken by air transport in the unified transport system of the U.S.S.R. will therefore reach a very high level by 1937.

Aviation is being developed in the U.S.S.R. not only as a means of transport ; it participates directly in the industrial life of the country and finds application in approximately forty various forms of national economy. It has become particularly important in agriculture in consequence of the special features in the development of agriculture in the Soviet Union, based on collective large-scale production.

Aviation is being widely adopted in agriculture and forestry in the fight against pests. In 1933 the area covered by aeroplanes engaged in this work exceeded 400,000 hectares. In 1933 aeroplanes were also used for the annihilation of malaria mosquitoes over an area of 750,000 hectares.

In 1931 an interesting experiment was made for the first time in sowing rice from aeroplanes. The result was quite satisfactory and was thereafter adapted to other crops, in particular to the sowing of tree seeds and fodder grass. A most interesting experiment was the sowing of wheat from aeroplanes. In all these trials the results were quite satisfactory, both in regard to the crop and the cost of production, and in 1933 aeroplane sowing was adopted on an area of 137,000 hectares. At the present time aviation engineers are engaged in designing new types of aeroplanes that will be especially suitable for aeroplane sowing.

Aviation has also been useful in the country's economy in connection with surveying work. In 1933 150,000 square kilometres were photographed from the air, giving useful results in the surveying of fisheries and hunting-grounds, and in other instances. Owing to the system of planning the entire economic work of the country it has been possible to make considerable use of aviation in many spheres to which it would otherwise not have been applied.

MOTOR TRANSPORT

During the last five years inter-regional connections have developed at the same time as all kinds of inter-regional and local transport. A most prominent part is played by "rail-less" transport—road transport by motor vehicles and horses. This kind of transport includes a very considerable proportion of transport of goods to points where they are transferred to other means of transport, as well as transport to the places of consumption.

It is quite evident, therefore, that the increase of goods carried by railways, river, sea and air inevitably causes an increase of the goods turnover of road transport. However, its function is not limited to this kind of work.

Road transport has its own independent work to perform, carrying goods from the places of despatch to the points of delivery. It performs this function over a considerable radius around each industrial

centre, supplying the centre with agricultural products, timber and other goods, and in return conveying manufactured goods to the agricultural districts. In some parts of the U.S.S.R. inter-regional transport also is carried out by motor vehicles and horses, for instance on the Kachug highway extending over a length of several hundred kilometres. Goods intended for the district of Yakutsk are brought by rail to Irkutsk, where they are transferred to road transport, which conveys them to the port of Kachug on the river Lena, and they are then shipped from there to Yakutsk.

The requirements to be met by road transport have grown immensely during the last few years in connection with the reconstruction of the country's economy, the growth of new industrial centres in distant parts of the country, the development of urban construction, the building of a number of new cities like Magnitogorsk and Kusnetsk, as well as the establishment of agricultural centres distributed all over the territory of the U.S.S.R., viz. State farms and tractor stations, and the change from peasant farming to collective production on a large scale.

Formerly the peasant was contented with bad country roads and unpaved highways, on which he moved along with his miserable horse from village to village, from the village to the railway station and to the nearest town. The big centres of agricultural production of the present time, however, require

roads fit for motor transport. Formerly the regions of the national minorities, particularly in Central Asia, were conspicuous for their lack of roads ; now these same districts, with their economic and cultural development, urgently require the construction of roads. Formerly in many parts of the country industry and agriculture were still in a patriarchal primitive state, with antiquated means of production, and could do without communication with other regions ; this condition now belongs to the past, and in its place new types of cultivation and collective production have developed which are in urgent need of safe and reliable transport connections with other parts of the country.

The great importance of road transport for a Socialist economy, and the roadless state in which the country was left at the end of the Tsarist régime, have confronted the Soviet Government with the task of road construction on a large scale.

The construction of roads of general as well as local importance has been developing. Many republics and districts which formerly had not a single kilometre of good roads, have built them since the Revolution. In Central Asia, for instance, there were no roads of an improved type in the past ; while now there are more than 2,500 kilometres of such roads. By January 1, 1931, roads of the improved type in Karelia had reached a length of 1,146 km. At that time Bashkiria had constructed 32,000 km.

of roads, Kazakstan 84,000 km., the Transcaucasian republics 19,000 km.

The greatest extension of roads for motor and horse transport has been reached in the Moscow district, which has 800 km. of roads to every 1,000 square km. The second place belongs to the Chuvash Socialist Republic with 700 km. to every 1,000 square km., followed by the Crimean Republic with 600 km., the Western district and White Russia with 530 km., the Ukraine with 500 km., the Central Black Earth district with 450 km., and the Nishegorodsky district with 350 km. to every 1,000 square km. A smaller extension of these roads is now being made in the eastern districts.

According to the estimate made in 1931 the total length of roads for motor and horse transport in the U.S.S.R. amounted to 1,300,000 km., of which 41,000 km. were paved with stone ; 93,000 km. of improved roads were built during the first five-year period. Roads of great length were built, such as the Amur – Yakutsk highway of 869 km., the Chuisky highway of 598 km., and the Usinsky highway of 345 km.

The greatest achievement in the sphere of road transport is the creation of a motor transport system, which practically did not exist in Tsarist Russia, as the 8,000 motor-cars which it possessed, and of which little more than a thousand were lorries, hardly counted. All these cars were imported from other countries.

At the present time the Soviet Union possesses some very large works engaged in the building of motor-cars, of which the most important are the Moscow works named after Stalin, the Molotov works in Gorki, organised during the first five-year period, and the Yarolslav works. In 1932 these works produced 23,879 cars ; in 1933 49,753 cars. At the beginning of the first five-year period (1927–32) the motor park of the U.S.S.R. consisted of 18,700 cars, of which by far the greater part were of foreign origin. On January 1, 1933, the motor park had increased to 73,000 cars, and in the course of the year 1933 49,753 new cars were built.

During the first five-year period the number of motor-transport lines increased from 265 to 582, and their length from 14,582 km. to 35,255 km.

At the XVIIth Congress of the Communist Party the following decision was taken regarding the development of the motor-car industry : the capacity of the Gorki works was to be increased to 300,000 cars per year, that of the Stalin works in Moscow to 80,000, and that of the Guridan works to 25,000 five-ton trucks. New motor factories were to be built in Ufa and Stalingrad for turning out three-ton trucks, at the rate of 100,000 cars per year each ; and new works were to be established in Samara with a capacity of 25,000 five-ton trucks per year.

Thus in the near future the motor-car works will be able to supply the country with 700,000 new cars every year.

Such a development of the automobile industry shows what great importance is attached to motor transport in the U.S.S.R.

The amount of goods carried by motor transport in 1932 reached 1,000 million ton-kilometres; according to the second five-year plan it will reach 16,000 million ton-km. in 1937. The great increase in the number of motor-cars will require a very considerable intensification of the work of constructing roads of an improved type. In the course of the second five-year period 210,000 km. of such roads are to be built, in addition to roads built at the expense of local organisations.

The most important highways included in the plan of construction for the second five-year period are the following :

Moscow–Leningrad
Moscow–Minsk
Moscow–Gorki–Sverdlovsk–Ural
Moscow–Kharkov–Rostok–Tiflis
Leningrad–Kiev–Odessa
Kharkov–Kiev
Kharkov–Sebastopol

Moreover the construction of a number of important highways in Siberia, Kazakstan, Central Asia and in the north will be completed.

In this way the task of putting an end to the lack of roads will be fulfilled in the second five-year period.

The working masses of the Soviet Union are taking an active part in this work. In 1927 a society was organised for the promotion of motor transport and motor roads. It is called " Avtodor," and the number of its members has now reached three millions.

The society has branches all over the country, in big industrial centres as well as in the remotest villages, and is very popular among the workers of the Soviet Union, who are most anxious to achieve complete mastery over the motor-car, the tractor, the motor-boat and the motor-cycle. This explains the rapid development of the " Avtodor " society, the functions of which include spreading the idea of the use of motors and tractors among the masses of the population, giving the country millions of well-trained car drivers and tractor operators, taking an active part in the building of improved roads, and fighting for the use of motors in road transport.

A striking example of the important part played by the " Avtodor " society in the building of roads is the result obtained in the Chuvash republic. Here this society organised a special " week for constructing roads " in the course of which the population managed to build 374 km. of regional roads and 600 km. of roads for the collective farms, to repair 6,000 km. of village roads, to straighten out 165 km. of roads, to cut through woods, to root up the stumps on many hectares of ground, to build new bridges and repair old ones.

During this week the population of the eighteen districts of the Chuvash republic performed an amount of work estimated as 140,000 men days and 115,000 horse days. At the present time the Chuvash republic has 534 roads extending over 6,500 km., and in regard to the number of roads takes the second place after the Moscow district.

Another no less striking example of the important part played by the "Avtodor" society is the result of the motor run Moscow–Kara-Kum–Moscow organised by the society in 1933. Twenty-three cars of the Gorki automobile works and the Stalin works of Moscow, built entirely of Soviet materials, took part in this run, the chief object of which was to test the quality and durability of Soviet cars and Soviet rubber under the most difficult circumstances.

The route lay through nineteen different republics and districts along the good roads of the Chuvash republic and the rough village roads of the Tartar and Middle Volga districts, across the deserts and semi-deserts of Kazakstan, under the scorching sun of Uzbekistan, Tadshikstan and Turkmenia, across the unexplored desert of Kara-Kum with its sands and dangerous salt marshes, across the mountainous part of Azerbaijan, over the steep and dangerous Chombarski pass, through the capital of Georgia—Tiflis—and along the Georgian military road to the north of the Caucasus and from there back to Moscow.

This run demonstrated the good quality and

durability of the Soviet cars and rubber, the cars reaching Moscow after a run of 87 days, having covered over 10,000 km. without a single breakdown.

This run was also remarkable for the great interest in the Soviet machines shown by the population, and their eagerness to participate in the development of motor transport.

In Central Asia, from Cherniayev to Tashkent, 350,000 collective farmers stood in a double row along the road for 28 km., greeting the passing motor-cars and throwing to them flowers, melons, grapes, peaches and apples. In the Gishduvansk region the collective farmers erected 118 arches on the 30-km. passage of the motor-cars, these arches being beautifully decorated with carpets, silk shawls, bunches of grapes, melons, etc. The collective farmers of the Khorean district repeatedly watered the road in their district, having heard that dust might be harmful to the motors. It must be noted that in this district water is obtained with great difficulty and is worth its weight in gold. Each district, each collective farm, manifested in its own way the genuine enthusiasm felt by them for the Soviet-built motor-car, which had been created during the first five-year period.

POSTS AND TELEGRAPHS

The planned system of Soviet economy makes it possible to construct postal and telegraphic

communications in conformity with the transport system and with the general economic interests of the country.

We can safely say that posts and telegraphs were, in Tsarist Russia, one of the most backward departments of economic and cultural life. It is enough to say that in Tsarist Russia 60 per cent of the villages had no postal service at all, and instead of the hundred thousand village postmen now working in the Soviet Union there were none. In 1913, for a population of 139 million occupying an area of 21·8 million square kilometres, there were only 12,800 post offices, which were mostly concentrated in towns in the European part of Russia.

In 1913 there was one post office to 10,900 people and to an area of 1,700 square km., while in 1933 there was one to every 3,700 people and to an area of 480 square km. In the pre-war period the transport of posts was carried on by railways for 58,500 km., by water for 39,900 km., and over unmade roads for 170,900 kms. There were no motor or air lines. As a result correspondence travelled at a very slow pace.

Electrical communication was in an embryo state. The length of the telegraph and telephone lines was 502 thousand km. in 1913, and the Soviet Union now possesses 1,653 thousand km. In 1913 there was a total absence of brass and bimetallic wires for distant calls, but in 1933 there were 72 thousand km. of these in the U.S.S.R.

Telegraph and telephone communications were totally absent in the rural districts, whereas in the Soviet Union 47 per cent of village Soviets had telephones in 1933. The out-of-date apparatus of the " Klapfer and Morse " system dominated the telegraph system, constituting 96 per cent of the total of 8,225 transmitters.

For every 1,000 town dwellers in 1913 there were 7·6 telephone subscribers, whereas in the U.S.S.R. in 1933 these averaged more than 10·5 subscribers. The means of communication of Tsarist Russia had an old-fashioned equipment, including all existing sorts of telephones. The imperialist war and then the civil war, as in the case of transport, seriously affected the technically weak and little developed system of communications. A considerable number of telegraph and telephone lines were destroyed, electrical equipment and apparatus grew old, the already small number of post offices diminished, and lines of communication deteriorated. Before the first five-year plan the Soviet Government had put in order and reconstructed the means of communication which had been destroyed. But the reconstruction of the existing means of communication was not sufficient for the new demands of the country. To satisfy the continuously growing demands with the old technically backward means of communication was totally impossible. An absence of rapid and efficient communication between the centre of the Soviet Union and the republics, regions, districts,

and local and large-scale enterprises, as well as between regional centres and village Soviets, and State and collective farms, necessarily had a negative influence on the development of the economic life of the U.S.S.R. For this reason immediately after the pre-war level of production had been reached in 1927, the question of a wide reconstruction of all systems of communication arose. This found its reflection in the first five-year plan.

In 1932 the interchange of communications reached a total of 9,800 working units ; this was almost four times the pre-war total, and three times larger than the figure on the eve of the first five-year plan. The post penetrated to every far-away corner of the Soviet Union, and included not only towns and workers' settlements but all villages. Letters and newspapers are now delivered in the great majority of places in the U.S.S.R. regularly four times in each five-day week, and in many villages and the majority of machine-tractor stations daily.

The number of post offices has increased from 12,600 in 1928 to 44,600 in 1932, and the number of village postmen has increased from 20,000 to 103,000.

In towns and workers' settlements the delivery of correspondence and newspapers has reached ten times a day in large centres and twice in district centres.

The total capacity of telephone stations in towns

has increased from 290 thousand subscribers in 1928 to 580 thousand in 1933. A new system of automatic telephone stations has been created with a capacity of 133 thousand subscribers in 1933.

Transmitters have been widely introduced in factories and electric power stations for means of communication. At present Moscow has electrical communication with all capitals of republics and regional and district centres, including the most remote, as well as with the larger industrial enterprises. In their turn all capitals of republics and regional and district centres have electrical communication with their districts, a condition hardly existing before the Revolution.

In 1933 47 per cent of all village Soviets (the total for the U.S.S.R. being 64·8 thousand), 2,291 machine-tractor stations and 800 Soviet farms have electrical communication with their regional centres.

The number of telephones on local lines increased from 19,300 in 1928 to 56,000 in 1933. The length of telegraph and telephone lines increased from 890,000 km. in 1933 to 1,653,000 km. ; of the brass and bimetallic wires, which are characteristic of the period of technical reconstruction, from 36 thousand km. to 72 thousand km.

During the first five-year plan a number of new brass and bimetallic main lines (Moscow–Sverdlovsk, Novorossisk–Sverdlovsk–Chelyabinsk–Magnitogorsk, Moscow–Samara, Moscow-Stalinogorsk,

Kazlow–Saratov, Samara–Orenburg–Bulak, Charkhov–Esyum–Arktyomovsk, and a number of others) were put into operation. These points were connected not only with each other but also with Moscow. All main telephone and telegraph lines were equipped with apparatus for multiple calling, the Soviet Union having organised the production of these technically complicated devices.

The first telegraph-telephone underground cable Donbas–Kharkov–Moscow is being constructed.

Besides foreign systems of telegraph apparatus, Soviet rapid action instruments have been invented by the Soviet specialist engineers, Shorin and Treml, and are being put into use. Their working capacity is not lower than that of the foreign-made instruments. A new type of communication has been created in the radio. The number of radio-telegraph-telephone transmitters on main lines has increased from 49 in 1928 to 110 in 1933, and their power from 102 kw. to 328 kw.—that is, three times. Powerful ultra short-wave radio-telephone-telegraph transmitters of 15 kw. are in wide use. In 1933 the U.S.S.R. had radio and cable connections with New York, Angora, Paris, Berlin, London, Rome, Vienna, Berne, Teheran and Shanghai. Experiments on ultra short-wave radio communication and television have been extensively made. There is photographic transmission between Moscow–Tashkent by radio and Moscow–Leningrad and Moscow–Sverdlovsk by cable. The Soviet Union has raised this technique to

a high level. Thus, for instance, the U.S.S.R. has twenty-two broadcasting stations with a power of 10 kw., five stations with 100 kw., and one station with 500 kw. These stations have been built completely from Soviet materials. It should especially be noted that the most powerful radio station in the world, with a capacity of 500 kw., was built earlier in the U.S.S.R. than the similar one in the U.S.A.

In regard to the power of its broadcasting stations the Soviet Union occupies the second place in the world, after the U.S.A. The number of broadcasting stations increased from 23 in 1928 to 62 in 1933; their power from 127 kw. to 1,552 kw., i.e. twelve times.

This has made it possible to solve in the main the problem of a unified broadcast for the whole Soviet Union from the large centres of the U.S.S.R., and providing the national republics and autonomous regions with broadcasts in their national languages.

The number of receivers has increased very rapidly, having reached 2·1 million in 1932 as against 348 thousand in 1928. A great number of repair shops and charging stations have been organised and radio consultations instituted. The achievements of radio technique have become available for the working masses in town and country. Great work has been done for the development and reconstruction of communications in railway, water and air transport. Thus, for instance, all regional offices of

railway directors have telegraphic and the majority even a telephone connection with the People's Commissariat for Communications.

For the first time the automatic block system has been introduced on many thousands of kilometres of railway. Great use has been made of the semi-automatic block system, flag signalling, and electric and mechanical central control points.

Before the Revolution the universal means for signalling and communication was the imported Morse apparatus ; now the main means is the telephone. For the first time in the U.S.S.R. a number of main water routes, e.g. the Volga and the Dnieper, have been equipped with means of communication during the first five-year plan, by means of which a unified command of the river fleet has been instituted.

Finally, air transport is being equipped with the necessary electrical communication.

Tsarist Russia was completely dependent on foreign firms for technique and equipment. At present the U.S.S.R. produces its own apparatus and equipment for all kinds of communication—radio, telephone, telegraph, post and signalling. The total output of the electro-mechanical low-tension industry increased from 37 million rubles in 1927–28 to 311 million rubles in 1932. The five-year plan for this branch of industry was completed in three and a quarter years. During the first five-year period the technique of many new devices was mastered.

These include automatic telephone stations, of low and high capacity, powerful long- and short-wave broadcasting stations, apparatus for multiple calling with applied frequencies to tonal, supertonal and subtonal telegraphs, a rapid-calling telegraph apparatus, production of main cables, etc. Considerable research work has been organised, as has also the training of staffs for communications.

Until the first five-year plan there was only one technical school for communications. During the first five-year plan the People's Commissariat for Communications opened an academy, four higher technical schools, and twenty-one technical schools. The total number of students in these schools was 13,800, 1,600 in the academy, 5,000 in higher technical schools and 7,200 in technical schools. In Tsarist Russia there was only one electro-technical institute which, during the twenty-three years of its existence, produced 449 specialists, including several dozen low-tension specialists.

The work accomplished in the field of communications during the first five-year plan is far from being the limit of what is required by the development of the economy and the rise in the cultural level of the U.S.S.R. In the second five-year plan further work for the development of communications has been projected. The XVIIth Congress of the Party pointed out the necessity of a large extension of all kinds of communications, especially radio, and of a radical improvement in the quality of the work.

In fulfilment of this policy the interchange of communications is to be increased from 9,800 million working units in 1932, to 20,500 million in 1937, this being seven times higher than the pre-war level and twice as high as in 1932.

The enormous requirements of communication, both in quantity and quality, can only be satisfied by a further technical reconstruction of all kinds of communications based on the achievements of world science and technique. The total amount of capital investments in communications under the second five-year plan is 1,700 million rubles (exclusive of radio) compared with the 510 million rubles of the first five-year plan. The second five-year plan considers the following problems as the main ones in the field of technical reconstruction.

First, the cabling of the main lines Moscow–Kharkov–Donbas, and Moscow–Minsk, the equipment of brass and bimetallic lines with devices for multiple calling, which will permit of having ten mutual connections on the same line simultaneously, the use of standard rapid-motion apparatus with a typewriter key on cables and radio lines, the use of photographic transmission increasing the material transmitted to a whole newspaper column.

Secondly, the creation of powerful radio and telegraph and telephone lines supplemented by big broadcasting points in Moscow, Novosibirsk, Sverdlovsk, Khabarovsk, Alma-Ata, Tashkent, Leningrad, Archangel and other cities, with mechanised rapid

action transmitters and receivers, which will provide a quick connection with the most distant points of the Soviet Union. These lines will transmit not only signals and voice, but are being equipped with devices to transmit pictures, documents, signatures, facsimiles, etc.

Thirdly, a reorganisation of the existing system of communications (in which all regional and district centres and capitals of republics have a direct connection with Moscow only) into an inter-regional system, by organising about twelve powerful transmitting stations and establishing a direct telegraph and telephone connection between the larger capitals of republics and district and regional centres. The completion of this work will occupy part of the third five-year plan.

This will make it possible to do away with a large amount of relaying, and to direct the principal flow of communications into direct channels and combine all technical means of communications into one powerful complex in which radio, telegraph and telephone, each performing its own functions, will complement each other.

At the beginning of the second five-year plan, a number of regional and district centres (Khabarovsk, Irkutsk, Alma-Ata, Tashkent) had no telephone communication with Moscow, and 43 per cent of the district centres had no telephone communication with the regional centres.

The project of the five-year plan is to establish

direct telephone communication not only with capitals of republics and district and regional centres, but also with all the biggest enterprises of the Soviet Union. By the end of the second five-year plan all regional centres will have a two-way telephone communication with their district centres. All village Soviets will have telephone communication with their regional centres, instead of 38·8 per cent at the beginning of the plan. Forty per cent of machine-tractor stations and Soviet farms will be equipped with internal telephone communication by the end of the second five-year plan. On the largest ones 5,500 ultra-short-wave transmitters for connection with brigades working in the fields will be established.

In addition to the introduction of a more perfect postal system in town and village, the five-year plan proposes an extended programme for the mechanisation of the postal services and the complete establishment of a regular postal service in distant parts of the Soviet Union.

During the second five-year plan, communications will be greatly developed in industry and transport. In particular the proposal of the plan is to establish on existing railway lines and to organise on new lines the following kinds of communication : despatching, station, point, station despatcher, line, local- and main-line communication. The length of road equipped with the automatic block system will be increased from 582 km. in 1932 to 8,882 in

1937, and semi-automatic blocks from 13,400 km. to 20,000 km. The measures projected by the second five-year plan in the field of communications will beyond doubt be accomplished. The Soviet Union will have technically advanced and efficiently working communications.

As a result of all this the transport and communications systems of the Soviet Union have been raised high above the level of Tsarist Russia. The rather weak inter-regional transit relations have been considerably strengthened during the existence of the Soviet Republics, especially during the first five-year plan, and thus transport and communications have become powerful enough not only to provide for foreign trade (as they did under Tsarism) but, and this is especially important, for the internal needs of the country.

The most distant and neglected regions have now been connected by a unified Soviet transport system with all other regions, and on the basis of this interconnection will be able to develop their productive forces at a tremendous pace.

An especially important part in the strengthening of the inter-regional relations of the Soviet Union has been played by the development of the maritime routes in the Arctic, the Baltic–White Sea Canal, the Turksib Railway, the reconstruction of main lines in the European and Asiatic parts of the U.S.S.R. and the mastery of the age-old rapids of the Dnieper.

These new achievements deserve more detailed

consideration, which will show their part in the unified transport system of the U.S.S.R. as well as their influence on the economy of adjoining districts. This detailed consideration is given in the following chapters.

CHAPTER IV

THE NORTHERN SEA ROUTE

THE COAST LINE of the U.S.S.R. bordering on the northern seas and the Arctic Ocean extends over 29,000 kilometres. Here are the estuaries of large rivers such as the Pechora, Obi, Yenisei, Lena and Kolyma, which pass through territories rich in timber, mineral ores, furs and other natural resources.

The Tsarist Government showed very little interest in the economic development of the different nationalities inhabiting this vast expanse of land. No measures were taken to promote the establishment of means of communication.

On the other hand this part of Russia excited considerable interest among merchants of other countries, who not only explored the Arctic Ocean, but attempted to establish commercial shipping routes to the mouths of the Obi, the Yenisei and other rivers communicating with the Kara Sea. They brought sugar, tea, candles, groceries, haberdashery, drapery and other goods, and exported to European markets timber, furs, hides, hemp, etc.

THE NORTHERN SEA ROUTE

The Tsarist Government, fearing the influence of foreigners on their northern-sea frontier, did everything to prevent the development of foreign traffic with the Siberian tribes. At one time it was even absolutely prohibited, and a blockade was established at various strategic points on commercial shipping routes.

The economic relations of the northern tribes, who were deprived of any communication with other more developed districts of Russia, were therefore of a primitive patriarchal character at the time of the Revolution.

The Soviet Government set itself the task of overcoming this backwardness by developing new means of communication, by establishing regular transport connections with the industrial and agricultural regions of the U.S.S.R., and by developing the productive forces of the north, promoting the industrialisation of this district and the cultural development of its population.

THE WESTERN SECTION

Attempts were made to use, first, the shipping routes from Murmansk and Archangel to the east, to the mouths of the rivers Pechora, Obi, Yenisei and others ; and secondly, shipping routes leading from the east to the west, i.e., from Vladivostok, through the Behring Straits to the mouths of the rivers Kolyma, Indigirka and Lena. This led subsequently to the establishment of regular shipping

routes from Archangel to Hatanga, Lena and further to the east as far as Vladivostok, i.e. the aim was to organise a direct northern shipping route from west to east and *vice versa*.

At the present time there are four shipping routes from Archangel to the mouths of the rivers flowing into the Kara Sea, i.e. the Obi and Yenisei, which are used in accordance with the movement and condition of the ice. The first route leads into the Kara Sea through the Straits of the Yugorski Shar, between the continent and the south shore of the island of Vargatch. This is the route most frequently used, as the conditions in regard to the movement of ice are more favourable here than elsewhere. Radio stations have been established on the coast of the mainland to watch the movement of the ice and supply passing ships with the necessary information.

The second route passes to the north of the former, and leads into the Kara Sea by the straits " Karskie Vorota " (the gates of Kara). These straits lie between the northern part of the island of Vargatch and the southern part of the island of Nova Zembla. At the present time radio stations have also been established on these straits.

The third route passes through the narrow straits of Matochkin Shar between the high rocky coasts of the two halves of the island of Nova Zembla. This is the shortest of the four shipping routes from Siberia to Europe for the export of Soviet goods.

This route has also a radio station situated at the outlet into the Kara Sea, which keeps ships informed of the condition of the ice.

Lastly, the fourth route passes through the open sea to the north of the island of Nova Zembla, round Cape Shelania. This is used when the southern straits are blocked with ice. Here also a radio station has been established at the northern extremity of Nova Zembla.

Regular communication along these routes is effected with the assistance of a strong fleet of ice-breakers, some of which have become famous for their voyages across the Arctic Ocean, such as the *Krassin*, *Malygin*, *Lenin*, *Litke*, *Makarov*, *Sedov* and *Ermak*.

In 1932 the ice-breaker *Sadko*, which had been sunk before the Revolution, was raised from the bottom of the sea, and after repairs had been carried out it was added to the fleet of ice-breakers. The ice-breakers are assisted in their work by numerous aeroplanes.

As a result of the measures taken, the cargoes carried through the Kara Sea have greatly increased, and a great many more ships now call at the mouths of the Obi and Yenisei.

NUMBER OF SHIPS CALLING AT THE MOUTHS OF THE OBI AND YENISEI

Years	*Number of ships*	*Yearly average of ships*
1880–1889	7	0·8
1890–1899	27	3
1900–1909	8	0·9
1910–1919	37	4
1920–1929	87	9·9
1930–1931	67	33
1932	30	30

GOODS TURNOVER OF KARA SEA TRANSPORT

(in tons)

Years	*Export*	*Import*	*Total*
1914	2,379	3,523	5,614
1915	2,957	512	3,469
1920	10,483	—	10,483
1925	5,582	7,602	13,184
1928	17,107	12,271	29,378
1929	61,967	13,500	75,467
1933	99,900	3,000	102,900

THE EASTERN SECTION

Simultaneously with the organisation of the western section of the northern sea route, much work was being done towards the organisation of the eastern section, through the establishment of a system of navigation from Vladivostok through the Behring Straits to the mouths of the rivers Kolyma, Indigirka and Lena.

In 1911 two ships called for the first time at the mouth of the river Kolyma : the Russian steamer *Kolyma* and a small American schooner the *Kittiwake.* In 1912 this trip was made by the steamer *Kotik* instead of the *Kolyma.* During the following years of the Tsarist Government only one steamer made this voyage each year, which naturally had no great influence on the economic development of the district. After the Far East had been freed in 1923 from the Japanese occupation, the voyages to the mouth of the river Kolyma were resumed by Soviet ships, and the amount of cargo transported showed a constant and systematic growth, as can be seen from the following figures :

CARGOES TRANSPORTED TO MOUTH OF RIVER KOLYMA

1923	355 *tons*
1926	658 „
1928	824 „
1931	2,000 „
1932	10,000 „

In 1931 the first radio station was established on Cape Severny by the ship *Lieutenant Schmidt,* and this has proved to be of great importance for the navigation of the Arctic Ocean.

In 1931 the steamer *Lenin* was transferred from the river Lena to the Kolyma, which was the beginning of the development of navigation on that river.

The considerable increase in the weight of cargoes transported in 1931 and 1932 was a proof of the possibility of establishing a regular system of navigation between Vladivostok and the mouths of the rivers in the Yakutsk district without any serious risks or wintering in the ice.

In spite of the fact that the ice here is thicker than in the Kara Sea, these voyages are less dangerous than in the western part of the Arctic Ocean, because the ships pass along the coast through a strip of open water with one year old broken ice, which is formed as early as the month of July.

Thus the navigation of the Arctic Ocean was started from both ends, from the west and from the east. Every year the ships penetrated further in both directions, fighting for every kilometre of new passage through the ice, and at last it became evident that a direct sea route from the west to the east, from Archangel and Murmansk to Vladivostok, could be established.

THE "CHELIUSHKIN" EXPEDITION

In 1932 the Government, wishing to investigate the possibility of using this route, sent an expedition on the ice-breaker *Sibiriakov.*

The expedition was to complete the voyage from Archangel to Vladivostok in one summer. This was successfully performed by the ice-breaker, under the guidance of experienced sailors. But great difficulties had to be overcome ; it was necessary to fight for

each kilometre of the voyage ; and the ship was heavily damaged.

The voyage from Archangel to Vladivostok was accomplished, in 65 days, for the first time in history, furnishing practical proof of the possibility of using this direct route. This Arctic voyage of the *Sibiriakov* was of great scientific and economic importance.

In 1933 this experiment was repeated by the steamer *Cheliushkin*, which left Murmansk for the East in August 1933. Compared with the voyage of the *Sibiriakov* there was the difference that this long Arctic voyage was now attempted not by an ice-breaker, but by a steamer adapted for navigation in Arctic regions. The *Cheliushkin* was a cargo steamer of reinforced construction for navigation through ice. It was built entirely of steel in the yards of Burmeister & Wain in Copenhagen, in 1933. The principal dimensions were : length 94·55 metres, width 16·61 m., draught 7·74 m., cargo capacity 2,088 tons.

The *Cheliushkin* received instructions to take relief to the men who had been wintering on Wrangel Island to make scientific investigations with regard to navigation conditions in Arctic seas ; the voyage from Murmansk to Vladivostok was, as before, to be completed in one summer.

Throughout the whole voyage there was a terrible struggle with the ice. After having forced a passage through the ice of the Kara Sea, the *Cheliushkin* passed one of the most inaccessible points of the

north—Cape Cheliushkin. Here it met ten Soviet steamers which were engaged on other work. The leader of the *Cheliushkin* expedition, O. J. Schmidt, was right in calling this a unique parade, as from the discovery of this cape in the eighteenth century up to the year 1932 this coast had been visited by only nine ships, and now in the autumn of 1933 as many as eleven ships had met here at the same time. On the 4th of September the *Cheliushkin* passed through the Laptev Sea in a heavy storm, and twenty-four hours later it passed the Novosibirsk Islands, penetrating further and further to the east.

On the 14th of September radio operators and food supplies were sent from the *Cheliushkin* to Wrangel Island by an aeroplane that had joined the *Cheliushkin* from Cape Severny. This aeroplane brought some of the scientific staff from the island back to the steamer.

On the 19th of September, fighting its way through the ice, the steamer reached the island of Koluchino, which is only 280 kilometres from the Pacific Ocean. The considerable distance from Murmansk had been covered in forty days. There was such an accumulation of ice at this island that the *Cheliushkin* could not get out of the ice-fields until October 5. Two days later the *Cheliushkin* passed the island of Idilia and was making its way to Cape Serdtze-Kamen, from which the distance to the Behring Straits is only 80 kilometres. At this point, owing to an unexpected movement of the ice, the *Cheliushkin* was

driven towards the shore and, caught in an ice-field, it moved slowly towards the Behring Straits, which it reached at the beginning of November.

There was a moment when there were only two to three miles left to the open sea. However, owing to a sudden and violent storm coming from the direction of Japan, the waters of the Pacific Ocean were forced into the narrow Behring Straits and a strong current carried the *Cheliushkin*, together with the ice-field, back again to the north. On the 13th of February the steamer reached the fatal point where the pressure of the ice caused the loss of the ship.

The whole expedition, numbering 101 persons and including ten women and two children, was transferred to the ice. Under the guidance of so experienced an Arctic explorer as O. J. Schmidt, this was accomplished in perfect order, and it was possible to save a supply of fuel, warm clothes, food, building material, an SOS radio apparatus and the aeroplane of the aviator Babushkin.

Rescue work was urgently organised by the Soviet Government, and in a short time the best Arctic aviators and Soviet aeroplanes and airships, the steamers *Smolensk* and *Stalingrad*, as well as the ice-breaker *Krassin*, were sent to Vankarem.

After a great many difficulties the rescue operations, which lasted two months, were brought to a successful conclusion without the loss of a single life. All the members of the *Cheliushkin* expedition were rescued. Great courage was shown and heroic deeds

were performed by the Soviet aviators, particularly Molokov, Kamanin, Liapidevsky, Levanevsky, Doronin, Vodopianov and Slepnev.

Though the *Cheliushkin* was lost, the expedition yielded very important results, not to speak of the fact that it has been proved for the second time that the establishment of a regular shipping route across the Arctic Ocean is quite possible. This was almost accomplished by the *Cheliushkin*, which at one time was within two to three miles of the open sea.

The loss of the *Cheliushkin* will not have any influence on the continuation of the struggle against the ice of the north. On the contrary, the *Cheliushkin* expedition has strengthened the determination of the working masses to conquer the Arctic passage, and the experience obtained from this expedition will help them in the achievement of this aim.

In the course of the year 1934 new expeditions were sent out to establish fifteen new Polar stations at the points which are most difficult for navigation. New stations will be opened in Providence Bay, on Cape Serdtze-Kamen, on the island Koluchino, at Cape Vankarem, four stations in the Laptev Sea and two stations in the least accessible north-eastern parts of the Kara Sea—at Cape Olovianny and the island Russkich. Previous to the Revolution there were only four Polar stations in the Arctic Ocean, while in 1933 their number reached twenty-one, and in 1934 thirty-six stations with a staff of 450 workers.

The experience of the *Cheliushkin* has demonstrated the importance of aviation in the conquest of the north. This has led to the decision to create new aviation bases that will function all the year round in Franz Joseph Land, in the Kara Sea, on Cape Cheliushkin, in the Laptev Sea, at Tiksy, on Cape Severny and in Wellen.

According to the second five-year plan more than 200 million rubles have been assigned for the building of ice-breakers, the establishment of new Polar stations, the development of new aviation bases in the Arctic, and scientific work on the thorough exploration of the Arctic seas.

The work of establishing a direct northern shipping route is closely connected with the development of river transport on the main rivers of Siberia, the Obi, Yenisei, Lena, Indigirka, Igarka and Hatanga, by means of increasing the river fleet and improving the conditions of navigation.

All this will promote the development of the productive forces of the regions connected with the new shipping route. It will help in the creation of industrial concerns working on the basis of the natural resources of the region, producing coal, non-ferrous metals, timber and tinned food, as well as furs, all of which could be exported by the northern shipping route.

The development of the northern shipping route in the course of the second five-year period will be one of the principal factors in the rapid development

of the far north and the improvement of the economic conditions of the various national republics and remote districts (the Yakutsk, Ostiako-Vogulsky, Yamalsky, Taimyrsky, Evenkisky and Chukotsky national districts), thus putting an end to their economic and cultural backwardness.

CHAPTER V

THE BALTIC–WHITE SEA CANAL

FOR MORE THAN A CENTURY the Tsarist Government was discussing plans to join the Baltic Sea and the White Sea. In Old Russia all these projects existed only on paper, and only the New Russia succeeded in carrying out this vast enterprise, which is of such vital economic importance for that part of the country.

On the 2nd of August, 1933, the Council of People's Commissaries issued a decree taking over the Baltic–White Sea water route for exploitation under the name of the "Baltic–White Sea Stalin Canal," and to declare it open for navigation for vessels of the lake and sea-going type.

PROJECTS IN THE TSARIST PERIOD

The idea of joining these two seas has its own history. As far back as 1798, Bakin, a merchant from Pudosk, advanced the project of constructing a canal by joining the river and lake of Onega with the lake of Vodlozers. He laid great stress on the larch forests surrounding Lake Vodlozers, the export of which

would bring large profits to the Government. Bakin himself was attracted by the great profit he expected to make on the construction of the canal. At the same time a second project was presented by three merchants from Petrozavodsk and the director of the Olonetz works, the Englishman Adam Armstrong. They proposed a new plan to connect the two seas by joining Lake Onega with the White Sea through the Povenetz at Soroka.

Taking into account the strategic importance of the project, the Tsarist Government deigned to pay some attention to the proposals, and delegated its best specialist, General de Volant, the constructor of the Mariinsky Canal system, to make the necessary investigations. It must be mentioned that the Mariinsky system had been so badly built that its reconstruction at the present time will require more work and expense than would be necessary for the construction of a new system.

General de Volant, after taking a superficial survey of the territory on which the Petrozavodsk project was planned, was frightened by the considerable number of rocks and waterfalls, and gave the following report on the project : " The sum required for the realisation of this project is out of all proportion to the profit that may be expected from any such means of communication."

This was the end of the project presented by the merchants of Petrozavodsk. But the idea of connecting the two seas remained. The Russian and Karelian

merchants were fully aware of the necessity of intensifying the exploitation of the forests and of creating ways and means to transport the highly prized Karelian timber to the White Sea for export, and they understood that the construction of a canal would be profitable for themselves. Consequently new projects were presented to the Government every year on the part of merchant owners of fisheries and industrial concerns. However, owing to the inertness of the Government circles and conflicts between the various groups which had the ear of high officials, no serious attention was paid to these projects and the problem of the canal remained unsolved.

The enormous wealth of Karelia was almost untouched. The exploitation of Karelian timber—pine, fir, and birch, well known on foreign markets—was carried out on a very small scale and in a primitive way. Rich deposits of apatite were not exploited at all and were hardly known at that time. The enormous power of the waterfalls remained unused for thousands of years. Karelia was rich in minerals : iron, copper and gold were found in Lake Vyg. Karelian granite was excellent building material. There was an abundance of fish in the rivers and lakes. There were many possibilities of developing industry and agriculture—but none were attempted in Tsarist Russia.

CONSTRUCTION OF THE CANAL UNDER THE SOVIET GOVERNMENT

The attitude of the Soviet Government towards this project was very different from that of the Tsarist Government. The construction of the canal was decided on ; work was begun in 1932 under the administration of the O.G.P.U. (the State Political Administration), and in 1933 the canal was completed and handed over for use.

This canal, extending over 227 kilometres, was completed in the course of 21 months, an unprecedentedly short time, during which 19 locks, 15 dams, 12 sluice-gates, 49 dikes and 33 artificial canals were built. The earth-work done measured 21 million cubic metres, the concrete work 390,000 cu. m., and the laying of logs 921,000 cu. m. All this work had to be performed under exceptionally difficult geological and hydrological conditions.

In the building of the Baltic–White Sea Canal new principles of construction were adopted which revolutionised the practice of hydraulic engineering. In order to promote the greatest possible use of local building material—Karelian timber and stone—directions were given to reduce the use of iron and concrete to the minimum. Concrete was replaced by wood even in such important constructions as dams. Engineer K. M. Zubrik designed a new wooden dam of most original construction, in which sloping logs withstand great pressure. This type of

construction was used for the extremely important dam, the Shavansky.

Engineer K. A. Vershbitzky designed a type of wooden wall for locks of twelve metres in height, which has been adopted almost throughout the whole extent of the canal.

Metal sluice-gates were formerly always used where the water pressure was as high as it is in the White Sea Canal. Here it was proved by experiments that even in the building of such an important item as sluice-gates it was possible to use wood, and the majority of sluice-gates were thus constructed.

During the construction of the canal it was found that the soil often consisted of sand and water intermingled with boulders, which did not allow the use of the piles usually adopted in making foundations. The engineers were forced to design new methods for the construction of foundations for the bottom and walls of the sluices, placing them directly in the ground.

Accordingly a lighter type of bottom was used, with safety plugs which reduced the water pressure. In the laboratory of Professor Lebedev, a waterproof screen was designed consisting of layers of local material—peat and sand, the use of which made it possible to build dams, dikes, etc., with the soil of Karelia, so little adaptable for constructions of this kind. Thirteen out of nineteen locks were built on rock. Concrete is usually used on this kind of soil, but the adoption of wooden chambers of new

design made it possible to fix the wooden construction to the foundation.

The above are only a few instances of the wealth of new ideas realised in the construction of the canal, but they are evidence of the revolution that has been introduced in hydro-technical engineering.

All these novel forms of construction stood the test with great success when they were put into operation.

Very great difficulties were experienced by the builders in removing rocks. Four and a half million explosions were required to blow up and remove 2·5 million cubic metres of rock.

The construction progressed at quite an exceptional pace. For instance, the enormous Dubrovsky dike, 3·5 kilometres long, which absorbed 450,000 cu. m. of soil, was erected in the course of three months. There were days when the earth-work performed reached 130,000 cu. m. Thirteen thousand cubic metres of soil were taken out, and 8,000 cu. m. of logs laid in one day. Owing to this rate of construction the canal, 227 kilometres in length, was completed in one year and nine months, while the building of the Panama Canal of a length of 81·3 km., and that of the Suez Canal of a length of 164 km., took a number of years.

The methods adopted in the construction work were also quite original. It was organised and carried out by the O.G.P.U., and the labour was performed by convicts, thieves, murderers, bandits,

wreckers, prostitutes, and counter-revolutionaries. It was a grand experiment in re-educating people who had strayed from the straight path. This experiment proved that labour useful to the community and intelligently performed for a high aim has a much greater influence on the psychology of men than any punishment.

As a result of this education by labour 20,000 men obtained a higher qualification ; former pick-pockets, thieves, bandits, murderers, and prostitutes were turned into motor drivers, masons, concrete workers, navvies, woodcutters, carpenters, technicians, mechanics, and staff workers fit for service on the fleet of the Baltic–White Sea Canal as captains, pilots, mechanics, and sailors.

The return to a life of labour of these criminal elements which had been left over from Tsarist Russia was effected on the basis of emulation and shock work, which progressed together with the development of the work. The civil consciousness and cultural level of these people rose simultaneously with their qualifications. After the completion of the canal many of them, who had renounced their past and devoted themselves to a life of labour, were pardoned ; 12,484 persons had been completely reformed and had become useful members of the Socialist constructive society. Terms of punishment were greatly reduced for 59,516 people who had proved by their energetic work that they had returned to a life of labour.

The Order of Lenin, of the Red Star and of the Banner of Labour were awarded to a number of engineers, former wreckers who had since played a prominent part in the construction of the canal.

At the last meeting of the workers of the Baltic–White Sea Canal on August 24, 1933, many of those who had formerly been socially dangerous elements spoke of the great change which they had undergone while working on the canal, and of the wide prospects opening before them on their release. Here is a statement of the thief Ovchennikov, who had been convicted three times and had since been working on the canal as a mechanic, with the prospect of becoming a fully qualified engineer :

" In spite of anything that may be said to me, I know that the G.P.U. not only punishes but saves people. At the present time there are scores of men in our labour commune, who will, in a year's time, become engineers. Former thieves will become managers of industrial concerns."

Another former thief, Orlok, speaking of his shock work, said :

" We went up to our boss and said to him, ' Comrade, you may call up the guard or not, as you like, but we will go down to the bottom of the canal to-day and will not leave work before everything is cleaned up.' We did go down and worked until I put up a poster, requesting people to wipe their feet before entering the canal in order not to spoil the red mark. I wrote that poster myself. We sometimes

spent 57 hours at the bottom of the canal and our instructors were with us—working at the rocks together with us, and leaving only when their work was completed. Everyone forgot what he was, we are all members of one family."

Such was the educational influence of the work. We have mentioned this here because it is impossible to describe the construction of the canal without referring to the results achieved in the mass reformation of the convicts who built it. Such facts have hitherto been unknown in history.

Returning to our subject, it must be observed that the canal is of great importance for the transport of the U.S.S.R. Previous to its construction it took steamers seventeen days to sail the 4,000 miles from Archangel to Leningrad. They sailed along the Gulf Stream, then turning to the south crossed the route of foreign vessels in the Atlantic. And now after cutting through 227 kilometres of rocks and swamps a direct route from one sea to the other has been opened on the territory of the Soviet Union. The canal will have enormous influence on the economic development of Karelia. Immense quantities of timber from the mouths of the rivers Onega and Megan, Karelian granite, apatite, coal from the Pechora, oil from the Uhtinsky district, fish and other goods will be carried to the south to the places of consumption. Even in the year 1934 the amount of goods shipped by the canal reached 1,300,000 tons.

However, this is not the full extent of the important

part played by the canal. Firstly, it is the head section of the great northern sea route : Leningrad–Povenetz–Soroka–the Kara Sea–Cape Cheliushkin–the Behring Straits–Vladivostok. Secondly, in view of the proposed reconstruction of the Mariinsky Canal system during the second five-year period, it will connect the White Sea with the Volga and the Caspian Sea. Thirdly, a direct water route is being made from Moscow to the White Sea by means of the Volga–Moskva Canal now under construction. Fourthly, by means of the Volga–Don Canal a direct water route will be obtained connecting the Baltic, the White and Caspian Seas with the Sea of Azov and the Black Sea. The prospect in view is the creation of a unified system of water routes for the U.S.S.R., the realisation of which is steadily progressing. By the construction of the Baltic–White Sea Canal the inter-regional transport connections between Karelia and northern Europe have been considerably extended and show every sign of further growth. The question of increasing the capacity of the Murmansk railway has already been discussed, and a thorough reconstruction of this line is contemplated.

The inter-regional transport connections of the northern districts have also been improved. Formerly the entire transport was effected over the Archangel railway. At the present time it can avail itself of the Baltic–White Sea Canal ; and the big river basins of Onega, Mezen, Pechora and others,

rich in timber and minerals, will be able to ship their products to the White Sea and also along the canal to the interior of the Soviet Union. The inter-regional connections of the north have also been greatly improved by increasing the transport capacity of the Archangel railway, by building the railway between Bui and Danilov, a distance of 92 kilometres, and also by the line Gorki–Kotelnich, with a bridge across the Volga at the town of Gorki.

The goods transport turnover between the north and the other regions of the U.S.S.R. had already in 1932 reached 1,600,000 tons, five times more than in 1913.

Such is the important part played by the Baltic–White Sea Canal, the greater part of which was built in the first five-year period.

CHAPTER VI

DEVELOPMENT OF TRANSPORT IN THE UKRAINE

IN THE SOUTH OF RUSSIA special attention must be paid to the development of transport from the chief coal and metal base located in the Ukraine, the Donbas, which, besides supplying coal to the entire industry of the south, sends large quantities to the Moscow and Leningrad districts.

The coalfields of the Donbas were known in the eighteenth century, evidence of which is furnished by the decrees issued by Peter the First. However, the exploitation of these coalfields on a large scale was begun only in the middle of the second half of the nineteenth century, foreign capital having turned its attention to the wealth of southern Russia.

In 1914 coal production in the Donbas reached its maximum figure, 27·5 million tons. This was achieved by Tsarist Russia after a great number of years with the active assistance of foreign capital.

The discovery of rich iron-ore deposits in Krivoi Rog was the beginning of the development of a

metallurgical industry in the south of Russia. New works were opened one after the other, and in the year 1899 there existed eighteen blast furnaces and four works with an output of 1,355,000 tons of pig iron per annum. This was the period of the greatest development of foreign capital assisted by protective duties and Government orders. The natural resources of southern Russia, the existence of iron-ore deposits in close proximity to the coalfields, as well as the protective policy of autocratic Russia, attracted foreign capital, which owned nineteen of the existing twenty-four concerns.

Nevertheless it took the Tsarist Government a long time before the production of pig iron reached 3,110,000 tons in 1913, although the exploitation of the natural resources was carried out by methods of exhaustion.

During the imperialist war the output of coal and minerals decreased considerably, seventeen out of sixty-five blast furnaces being shut down. This was chiefly caused by the deficiencies of transport, which became strikingly evident during the war. The coal and metallurgical industries of the south suffered greatly under the occupation of the Ukraine by German troops and the rule of the White Guards. The production of coal decreased to 4·5 million tons, and the smelting of pig iron to the trivial figure of 29,500 tons in 1920. This sad inheritance of the Tsarist period was not only remedied, but the whole industry was largely reconstructed and developed

by the Soviet Government. In 1932 the coal output of the Donbas already exceeded that of 1913 by 73·8 per cent, having reached 43,940,000 tons. The smelting of pig iron in 1932 exceeded the pre-war output, and amounted to 4,220,000 tons.

The reconstruction of the coal and metallurgical industries resulted in the building of new works, such as the Dnieprostroi works, the Kharkov tractor works, the Lugansk locomotive works, the Kharkov turbine works, the Saparozhstal and Azovstal steel works, the Tomsky, Voroshilov and Rykov metallurgical works, the Marty shipbuilding works, the Sumy factory for producing chemical equipment, the Kramatorsky machine-building works, new woodworking mills, and factories for the light industries and food industries.

The great economic development of the Ukraine imposed new tasks on the transport system. In 1913 the freight turnover of the Ukraine railways was 50 million tons, while in 1932 it reached more than 90 million tons. The urgent necessity of increasing the inter-regional transport connections of the Ukraine became evident ; this was particularly the case in regard to communications with the Moscow and Leningrad districts, with White Russia and the Volga district.

A new railway—the Voroshba–Unecha–Orsha line—was built to increase the transport connections between the Donbas and the Leningrad district. It is 425 km. in length, and facilitates the transport

of coal from the Donbas by way of Krasny–Leman–Osnova (Kharkov) – Lubotin – Voroshba – Unecha – Orsha–Vitebsk–Dno–Leningrad. No such trunk line existed previously, as there was no connection between Orsha–Unecha and Voroshba.

The capacity of the old route Krasny–Leman–Osnova – Lgov – Navlia – Briansk – Smolensk – Vitebsk –Dno–Leningrad has also been greatly increased by the building of additional tracks on the line Osnova–Lgov–Navlia. In addition a new railway has been constructed between Briansk and Viasma, 234 km. long, which has made it possible to send wagons of coal, metal and grain from the Ukraine to Leningrad by way of Kharkov, Lgov–Briansk–Viasma–Rsheff–Lihoslavl–Leningrad, avoiding the Moscow junctions.

Thus, instead of two inconvenient connections between the Ukraine and Leningrad there are now four routes, each of much greater capacity, which means a considerable development of the inter-regional connections with Leningrad.

No less attention has been devoted to the improvement of inter-regional connections between the Ukraine and Moscow, which was formerly effected by two trunk lines through Briansk and Orel. The first line passing through Briansk was of small capacity, and therefore a second track was added on the line Osnova–Lgov–Navlia. The line passing through Orel and Kursk was also reconstructed and its capacity increased.

Lastly, the railway line passing through Eletz, which was of little use, as it had no connection between Uzlovaya and Venev, is now being thoroughly reconstructed ; the gradients are being reduced, and a second track, 1,135 kilometres long, is being added. It will be ready for use in 1935, and will connect the Donbas with the Moscow district.

Considerable work has been done in improving the connections within the Ukraine, particularly between the Krivoi Rog district and the Donbas. Here second tracks have been laid on the trunk lines and a distributing station has been built at Verhovtzevo with twenty-four tracks, at the outlet of the Krevorok iron-ore district.

Owing to the construction of the railway Merefa–Konstantinograd –Nishnedneprovsk – Apostolovo – Kherson, 520 kilometres long, a new connecting line has been established between Kharkov and all the industrial and agricultural centres of this region on one side and the port of Kherson on the Black Sea on the other. This has improved the connection between the Ukraine and Transcaucasia, which is of great importance for the transport of oil to the Ukraine.

The capacity of the railway line Likaya–Stalingrad has been increased. This facilitates the transport of Donbas coal to the Volga for further shipment along this river to the industrial centres ; it also provides a route for the supply of timber from the north to the Donbas.

A further development of the inter-regional connections of the Donbas, the Northern Caucasus and the Volga district will become possible when the construction of the great Volga–Don Canal, which has now been started, is completed.

Inter-regional connections between the Ukraine and the Urals have been improved by adding a second track to the railway Kupiansk–Liski–Balashoff – Rtishevo – Penza – Syzran – Samara – Ufa – Cheliabinsk.

In this way the Ukraine has been given transport connections of great capacity with the other industrial and agricultural regions of the country, particularly with Leningrad and Moscow.

This survey of the improvement of transport would not, however, be complete without mentioning the development of the river routes of the Ukraine, and particularly the Dnieper. The solution of the problem of the Dnieper is one of the most remarkable achievements of the Soviet Union and deserves to be handled separately.

CHAPTER VII

THE NEW DNIEPER

THE SOVIET REPUBLIC has solved the great task of creating an uninterrupted waterway along the whole of the river Dnieper. This was a task which was beyond the power of Tsarist Russia.

The river Dnieper rises in the western region somewhat to the north of Smolensk and, after winding for about 2,200 kilometres, enters the Black Sea. At its mouth it is connected with the river Ujnui Boug by means of the Dnieper–Boug estuary, and together with its tributaries forms an immense waterway with a net of water routes 27,700 km. in length, 6,000 of which are open for big ships and 11,500 for light draught vessels. The main tributaries of the Dnieper are the Berezina, 500 km. long, the Soga, the Pripet and the Desna. The Dnieper–Boug basin occupies one of the first places in the Soviet Union for its navigable rivers, second only to that of the Volga and of the Obi-Irtysh and almost equal to the Northern Dvina and Yenisei basins.

Until quite recently the Dnieper was divided by the rapids between the towns of Dniepropetrovsk (formerly Ekaterinoslav) and Saproghie (formerly

Alexandrovsk) into two independent and isolated basins : (1) the Upper and Middle Dnieper, 1,500 km. long, with the tributaries the Berezina, the Boje, the Pripet and the Desna, and (2) the southern part, that is, the Lower Dnieper–Boug basin. The latter always had a free outlet to the Black Sea, whereas the Northern Dnieper was isolated from the southern part and from the Black Sea by nine rapids extending for 65 km. and precluding navigation, besides 25 waterfalls having a total drop of 31 metres.

This is explained by the fact that in this part of the river the Dnieper crosses a ridge of rocks which branch off from the Carpathians, appearing here on the surface.

As one of the attempts to open the northern part of the Dnieper to the sea, we may point to the construction, just before the 1914 war, of artificial connecting systems in the upper part of the Dnieper, on the Pripet towards the Visla, on the Yaselda (a tributary of the Pripet) towards the Neman and on the Berezina towards the Western Dvina through its tributary the Ulla. All these three connections were intended to give an outlet to the Baltic Sea for the northern part of the Dnieper. But these measures were far from solving the question of the isolation of the Dnieper basin, the more so because the first two connections after the imperialist war fell into the possession of Poland, and in addition none of them were designed for big ships and a large volume of traffic.

The Dnieper rapids remained a natural barrier for the direct navigation of the Dnieper, prohibiting an issue to the Black Sea for the northern part of the river. The question of overcoming this natural barrier had attracted the attention of Tsarist Russia for a long time. Attempts to improve navigating conditions by means of erecting engineering devices were made at the end of the eighteenth century and then repeated in the first half of the nineteenth century. Then from 1905 and up to 1917 there appeared a number of private and State projects that took into consideration the use of water energy and the improvement of navigation on the Dnieper. But the matter did not go further ; these projects and the problem of the Dnieper remained unsolved by the technical and engineering resources of Tsarist Russia.

The solving of this problem was undertaken by the Soviet Government. A research organisation was formed under the direction of the Academician I. G. Alesandroff, the author of the project. The main difference of Alesandroff's project from the former ones was that the entire rapids of the Dnieper were dealt with by a single dam, and therefore the whole energy of the rapids was consumed by one hydro-electric station. This project presented the greatest economic advantages, and was the most rational from the technical point of view of all the projects advanced.

The plan was approved by the Council of People's

Commissaries of the U.S.S.R. ("Sovnarkom"), and in March 1927 the construction of the Dnieper hydro-electric station was begun. On May 1, 1932, Dnieprostroi produced its first energy. This tremendous and complicated technical construction was completed in five years. During this time 1,180,000 cubic metres of concrete were laid, including 820,000 cu. m. used for the dam; the removal of earth was carried out to the total of 3,400,000 cu. m.; excavating, 3,200,000 cu. m.; stone-breaking, 1,900,000 cu. m. During the construction period of 1930 the Dnieprostroi "udarniks" ("shock workers") developed a hitherto unknown rate of construction, leaving far behind all world records of concrete laying. During the construction period of 1930 they laid 518,000 cu. m., giving a maximum of 110,600 cu. m. per month and a maximum of 5,270 cu. m. per day. In five years a hydro-electric station of 810,000 h.p. was built, with ten turbines; a dam 62 metres high was erected, the length of the fall line being 611 metres.

Simultaneously with the erection of the dam and the Dnieper hydro-electric station the rapids were conquered and the Dnieper became navigable along its entire length. What Tsarist Russia had been dreaming of for a century and a half, the Soviet Union accomplished in five years.

The Dnieper basin occupies an area of 500,000 square kilometres. It touches the Krivoi Rog iron-ore basin, with an iron-ore reserve of 1,140 million tons,

the Nicopole manganese mines, with an ore reserve of 369·5 million tons, a considerable part of the Ukrainian reserve of brown coal, peatfields good for exploitation, phosphates, forests, developed agriculture and great industrial enterprises, especially in the industrial region of Dniepropetrovsk (Dniepropetrovsk, Komenske, Sovorogie, Nicopole, Krivoi Rog). The mining and iron ore, manganese, ferrous metals and machine-building industries are well developed here. The industry of the forests and steppes is chiefly represented by light industry—that is to say, sugar-refining plants and timber mills.

Other big industrial centres are Kiev (ferrous metal industry and machine building), Nicolaev (shipbuilding), and the Briansk region (machines for transport). Together with the construction of the Dnieper electric station, work on the construction of the Dnieper Industrial Combine is being carried on. The latter will include metallurgical works, electrosteel plants, ferro-alloys and aluminium works.

The rural economy of the Dnieper basin consists of agriculture and animal husbandry, as well as flowers, vegetables, melons and grapes, which give abundant crops in the fields of the State and collective farms. The new Dnieper must satisfy the demands for transport of the agricultural, forest and industrial centres situated in its basin.

The Dnieper will receive large cargoes of oil from the south, which will go to the industries situated higher up the Dnieper and in the western

region and White Russia. In return the Dnieper will receive timber for the Ukraine.

Thus the Dnieper will improve the connections between the different regions of the Ukraine, White Russia and the western regions. The Dnieper navigable along its whole length is a striking instance of the successful construction of the great works of the first five-year plan, and this river will now form a basis for the further construction carried on under the second five-year plan.

CHAPTER VIII

TRANSPORT CONNECTIONS WITH THE CAUCASUS

BEFORE THE REVOLUTION, in spite of the big oil centre in Baku, Transcaucasia formed a backward agricultural region. Azerbaijan itself, on whose territory the oil wells were situated, was " a country of the most backward, patriarchal, feudal relations " (Stalin). The oil industry was, from a technical standpoint, an extremely backward branch of industry, the oil beds being exploited in a wasteful manner : 94·1 per cent of the oil was obtained by a technically backward method of dipping, and only 1·1 per cent by means of deep pumps ; compressors were not used at all.

Under the Soviet Government the oil industry was technically reorganised, and the oil output increased. In 1932 the oil output amounted to 21,381,000 tons, which shows an increase of 131·5 per cent as compared with 1913. The methods of extracting oil were radically changed. In 1932 the amount of oil obtained by dipping constituted 6·3 per cent ; 22·3 per cent was obtained by means

of deep pumps, and 51·3 per cent by compression. In 1913 4·8 per cent of the total output was obtained from gushers, and 24·3 per cent in 1932. The technical reorganisation of the Transcaucasian oil industry resulted in the fulfilment of the first five-year plan for the oil industry not in five but in two and a half years.

Simultaneously with the oil industry, other branches of industry developed. Thus began the industrial exploitation of the Tverkchel and Tkvibul coal-mines and the Allaverdua and Zangegur enterprises for non-ferrous metallurgy were brought into operation. There was also an increase of manganese output in the Chiatoury mines. This growth in the exploitation of the natural resources of the country was strengthened by the development of our own machine building, which was effected by the organisation of works producing equipment for oil extraction and refining (especially the great Lieutenant Schmidt works), and by the construction of the big Tiflis engineering works and others.

The food and other light industries of Transcaucasia have also been considerably developed. Two big cotton factories were built ; in addition to a silk-winding combine in Nikha (which is the largest in the world) a whole series of tea and tobacco factories, a sugar refinery, a meat combine in Armenia, another in Baku and various other enterprises were built and put into operation.

The rapid industrial growth of Transcaucasia was

based on its powerful sources of energy consisting of big electricity stations, among which the most remarkable are the Transcaucasian, Dzorwajet and Rion hydro-electric stations.

There was a development of agriculture, the sowing area in Transcaucasia amounting to 2,585,000 hectares in 1932, 1,095,000 hectares being under cereals. But in spite of the considerable importance of cereals Transcaucasia specialised in subtropical cultures, the soil and climatic condition of the country being specially favourable for them. Finally an extremely important factor was the creation in Transcaucasia of a cotton base, which in 1932 already covered 250,600 hectares.

This phenomenal economic growth of the Transcaucasian republics demanded an increase in the work of all kinds of transport, especially railroad, maritime and oil transport. In the period from 1913 to 1932 there was an increase from 4 million tons to 7·3 million tons in railway transport alone. A still greater increase took place in maritime transport, especially of oil, which was caused by the fulfilment of the five-year plan for oil in two and a half years. Naturally the increasing cargo turnover has greatly strengthened the inter-regional relations of Transcaucasia with other parts of the Soviet Union, whose industry, tractors, motors, as well as everyday consumption needs, were dependent on the Transcaucasian and North Caucasian oil. The oil is chiefly exported by the maritime transport system

of the Black and Caspian Seas. The Caspian fleet takes oil to middle Asia through Krasnozavodsk, and delivers oil to Astrakhan for the European part of the Soviet Union, the oil being taken to the north by the Volga.

The maritime transport of the Black Sea takes the oil to Leningrad and Vladivostok as well as to the Ukraine by way of the Dnieper. In Odessa the oil is transferred to the railway for White Russia and the western and Leningrad regions. Moreover the Black Sea fleet takes Soviet oil abroad.

The railways play a smaller part in the transport of oil directly from the Caucasus. The flow of oil and oil products goes from Baku to Batum on the Black Sea by the Transcaucasian railway through the Suram pass. The transport capacity of this line was very small in pre-revolutionary Russia. Recently this line has been considerably improved, a second line of rails has been laid, automatic blocks have been introduced for 167 kilometres in the Adgicabul–Elakh and 87 km. in the Akstafa–Navtlug sections. The steepest gradient after Tiflis, Stalinsk–Zestafony, 63 km. long, has been electrified. At present the next section, Navtlug–Stalinsk, 120 km. long, is also being electrified. Half of the work was already completed by the middle of 1934. All these measures, especially the electrification of the mountain pass, have considerably increased the transport capacity of the Transcaucasian railway.

To supplement the Transcaucasian railway a

pipe-line, Baku–Batum, 822 km. long, has been constructed ; its capacity is 1·6 million tons. The North Caucasian railway from Makhach–Kala to Rostov, which carries Transcaucasian and North Caucasian oil products to the interior of the country through Rostov, has also been considerably strengthened. Under the five-year plan automatic coupling has been installed on the lines Prokhladnaya–Gudermes –Grozny and Gudermes–Makhach–Kala. Automatic coupling has also been introduced on the Rostov–Tikhoretskaya line. Moreover, this line has been strengthened by a second track in some sections and an increase of the carrying capacity of the trains.

To relieve the North Caucasian railway, a pipeline 618 km. long has been built from Grozny to Tuapse, and another one 486 km. long from Armavir to Trudowaya, with a capacity of 1·7 million tons. This has considerably increased the transport facilities of the Caucasus.

During the second five-year plan the oil industry will be developed on an unprecedented scale ; the oil output will be increased by 210 per cent as compared with 1932. This gives rise to the problem of a further increase of the carrying capacity of railways and maritime transport. A great part will be played by the Black Sea railway which is now nearing completion. It will go along the coast of the Black Sea from Akhal–Ochemging–Adler and further through Tuapse to join the main line. In the near future a new railway will be built crossing the

Caucasian mountains ; it will go from Prokhladnaya south to Tiflis, thus shortening the route by more than a thousand kilometres.

In this way Transcaucasia is increasing its inter-regional connections and at the same time its transport connections with other parts of the U.S.S.R.

CHAPTER IX

TRANSPORT CONNECTIONS OF THE URALS AND WESTERN SIBERIA

COMING NOW to the east of the U.S.S.R., we must first consider the strengthening of communications between the Ural-Kuznetsk Combine and other regions, as the Ural-Kuznetsk Combine forms the main link of the whole eastern chain.

This combine is a group of mines and factories organised as a single unit ; it is the second most important coal and metal base in the U.S.S.R. The Urals are rich in iron ore of the highest quality. Kuzbas (the Kuznetsk coal basin) is rich in first-rate coking coal. The distance between these two points is over 2,000 kilometres. The iron ore of the Urals must be brought to the Ural iron-works, including the giant Magnitogorsk works, and also sent to Kuzbas for the Kuzbas metallurgical works. On the other hand the coking coal of Kuzbas is used at the Kuzbas iron-works and also brought to the Urals for their metallurgical works. A big Soviet engineering industry will be built up on the basis of the Ural and

Kuzbas metallurgy. This is the general idea of the Ural-Kuzbas combine which has been put forward by the Soviet Government. It is quite evident that the solution of this problem imposes most serious tasks on transport.

The problem of creating a second coal and metal base has been tackled and solved by the Soviet Government. The Tsarist Government did not pay any attention to the industrial development of the east, and the metallurgy of the Urals, being in an undeveloped state under Tsarism, decreased in importance every year.

In 1908 (before the imperialist war) 1,890,000 tons of pig iron were smelted in the territory of the former Russian Empire. Of this quantity 340 tons, smelted in a very primitive handicraft manner, were the share of Western Siberia. The metallurgy of the Urals was for some time under the Tsardom the main metal base within the Russian Empire. In 1908, when Western Siberia produced 340 tons of pig iron, the output of the Urals was 426,000 tons. At the basis of the " organisation of labour " in the Urals, as Lenin showed, lay serfdom, the traces of which were more or less felt till the last days of the Tsarist régime. This in fact was the cause of the decrease of production in the Urals during the period of development of capitalism in Russia.

Before the Revolution wood was the main fuel in the east of Russia, not only for the domestic use of the population, but for industry and to a considerable

extent also for transport. Coal occupied a modest place—about 8 per cent of the fuel consumed. Still less can be said about the use of oil or electricity in the east before the Revolution. In 1913 the coal output in the Urals reached its maximum figure for the whole period of coal mining in Tsarist Russia, namely 1·5 million tons.

Thus the resources of the Urals were extremely weakly developed, and their industry was based on antediluvian methods of production, while Western Siberia was an agricultural country with a complete absence of industry. The November Revolution of 1917 put an end to the social conditions which for a century had prevented the economic development of the Urals and Siberia.

The estimated coal reserves in the Kuzbas area amount to more than 450,000 million tons ; above 1,000 million tons of iron have already been discovered in the Urals ; there are rich sources of water-power, forests, oil wells, and finally considerable areas for the development of agriculture. All these resources provide a natural basis for the development of industry in the east.

The share of the eastern regions of the U.S.S.R. in the total output of pig iron increased from 19·7 per cent in 1913 to 25 per cent in 1932. This increase is the result of the bringing into operation of the first units of the Magnitogorsk and Kuzbas metallurgical works, and the reconstruction of the metallurgy of the Urals. The full operation of the works already

constructed and the completion of the construction now in hand in the east will still further increase the importance of the east in Soviet metallurgy.

During the second five-year plan construction of new metallurgical works will be completed in the east, among them a second Kuznetsk works.

The same considerable shift to the east has taken place in the coal industry, which before the Revolution was concentrated exclusively in the Donbas. There has been a great increase in the share of the east in the total coal output :

1913	11·7 per cent
1927–28	19 per cent
1932	25·8 per cent

The unprecedented development of the metallurgical and coal industries has given rise to a number of gigantic engineering works in the eastern territory, the most important of which is the Ural-Kuznetsk Combine. During the first five-year plan the Sverdlovsk engineering works were built in the east with a capacity 100,000 tons of finished products. These works are equipped with powerful presses of 3,000, 6,000 and 10,000 tons, and like the Kramatorsky works in the Ukraine, in their capacity and technical devices have no rivals in any country in the world. With the full operation of the Sverdlovsk and the new Kramatorsky works in addition to the complete reconstruction of the old mining and metallurgical engineering works, by far the greater part of the

equipment required for the metallurgical and fuel industries will now be produced within the Soviet Union.

A plant for caterpillar tractors has been erected in Cheliabinsk, which when completed will produce 40,000 tractors a year with a total of two million h.p.

Iron-works in Verkhniy Saldinks and gigantic departments for iron production in Kuznetskstroi and Magnitostroi have been erected. The Nijni Tagyl Wagon-Building Combine of the Ural nickel-works, with a capacity of three thousand tons, is being completed. The production of copper will be increased by the complete reconstruction of the Krasno-Ural Combine, the Palshminsky and the Central Ural works. The construction of the Siberian textile engineering works and the Siberian works for mining equipment is in hand. The Berezniki Chemical Combine has been built. The potash mines in the Urals are being developed. The coke and chemical industries are growing in the Kuzbas and the Urals. The construction of the Kuznetsk locomotive works has begun. A number of existing works, including those at Zlatoust for machine tools and at Cheliabinsk for agricultural machinery, have been reconstructed and enlarged.

A number of factories for food and other light industries have grown up, such as the cotton combines in Barnaoul and sugar refineries. The wood-working industry has increased, especially in Western

Siberia. The second five-year plan proposes a still greater development of industry, agriculture and wood-working in the Urals and Western Siberia.

The Urals are to become one of the most technically and economically advanced industrial centres of the U.S.S.R. By the end of the second five-year plan the Urals will occupy the third place in coal output, the second in ferrous metallurgy (the Magnitogorsk works alone will yield 2·7 million tons of pig iron), the first in copper, the second in aluminium, and in their export of wood pulp the second place in the U.S.S.R. Sixteen new centres are to be created for light industry, and thirty-six for the food industry ; as a result of this the Urals will have their own base for the production of consumption goods. In order to provide the rapidly increasing industrial population of the Urals with meat, dairy products and vegetables, a great increase of agriculture, especially of stock raising and vegetable and melon cultivation, will be introduced. Western Siberia will develop at no less a rate. Kuzbas must become a second Donbas. The production of machinery will be increased six times in the five years. The chemical industry will be developed on a very large scale, as well as the production of electrical energy. Twenty-five coal mines with a capacity of forty-four million tons will enter into production.

The building of all essential departments in the Kuznetsk metallurgical works is to be completed, and a second works built. New locomotive works in

Kuznetsk will be constructed and a chemico-metallurgical combine will be built at Kemerovo. Thus Western Siberia will become a region with a specially concentrated and technically advanced large-scale industry. Moreover, to provide the growing working staffs of Western Siberia with consumption goods, the food and other light industries must be developed on a large scale. The sowing area will be increased by 23 per cent, the wheat area by 38 per cent and beet cultivation will be increased almost four times. The increase in stock raising will be no smaller. In addition the working up of agricultural products will be increased.

To sum up, during the second five-year plan the construction of the second coal and metal base—the Ural-Kuznetsk Combine—must be completed. With this aim the Soviet Government, out of the total of its capital investments, has assigned about 25 per cent, or above 30 milliard rubles, for the completion of the Ural-Kuznetsk Combine.

We need not labour the point that such a tremendous growth of the second coal and metallurgical base alone has confronted Soviet transport with great problems during the first and even more during the second five-year plan. During the years of the Revolution the goods traffic on the railways of the Urals and Western Siberia has considerably increased. This is clearly shown by the following table :

GOODS TRAFFIC

(in million tons)

Regions	*1913*	*1926*	*1932*
The Urals	5·7	8·1	18·2
Siberia	2·9	4	16·9

This is in fact an unprecedented growth. The growth in 1927–32, that is, when the large construction programme was being carried out, was especially rapid. In 1932 the Urals increased their railway shipments three times and Siberia increased hers almost seven times.

During the second five-year plan this traffic will increase still more. It will increase particularly on the main Siberian line Kuznetsk–Leninsk–Novosibirsk–Omsk–Ural, where the coal from the Kuzbas to the Urals will go in one direction and Ural ore back to the Kuzbas in the other.

The old single-track line was very inefficient from the technical point of view ; it had a low carrying capacity and could not meet the requirements of the east of the U.S.S.R. Therefore it was decided to reconstruct the Ural–Kuzbas main line, on which the bulk of the cargo and passenger traffic will be concentrated. A new line Ysyaty–Kuznetsk was built, 160 km. in length. It connected Kuzbas with the Siberian line. A new line was built from Leninsk to Novosibirsk, 295 km. in length, with a big bridge across the river Tom. It shortened the route for Kuzbas coal on the Siberian line by almost 100 km.

Another line, 363 km. long, was constructed from Sverdlovsk to Kurgan ; it provided the shortest route from Sverdlovsk, the centre of the Urals, to the Siberian line, thus being the third outlet from the Urals, supplementing the two existing outlets Omsk–Tumen–Sverdlovsk and Kurgan–Cheliabinsk –Sverdlovsk. A line was built from Kortaly to Magnitnaya, 146 km. long ; it connects the Magnitogorsk Metallurgical Works with the main line. Moreover, the main line through Kuzbas–Leninsk–Novosibirsk – Omsk – Petropavlovsk – Kurgan – Cheliabinsk – Kortaly – Magnitnaya will be doubled. The main railway junctions Kuznetsk, Leninsk, Novosibirsk, Omsk, Kurgan, Cheliabinsk (Poletaevo), Kortaly, Magnitnaya and a number of smaller junctions have been extended and reorganised. The main gradient on the Siberian line has been reduced to 0·004 ; the general condition of the railway has been improved, and the number of sleepers per km. increased ; new and heavier rails have been laid ; the ballast layer has been strengthened, repair shops have been extended, and the main line supplied with new and more powerful engines ; new large open metal, automatically unloading wagons for the transport of coal and ore have been brought into use ; considerable work has been done for the mechanisation of loading, especially in the region of the Kuzbas and Magnitogorsk works. Communication and signalling devices were also reconstructed on the main line. Altogether

the Siberian main line has been entirely transformed; nothing like it existed in the old Russia. It has become a well-equipped main line with a high carrying capacity. At the same time important work on the development of the local lines in the Kuzbas has been carried out, especially on the Ural railways, where a number of new lines have been built, tracks and junctions reconstructed, and the main industrial Ural line Kizil–Chusovaya, 112 km. in length, has been electrified. This line will soon be completely electrified as far as Sverdlovsk. But the work of strengthening the Siberian main line is not completed. During the second five-year plan it will be supplied with automatic coupling which will double its carrying capacity. Moreover, the main part of the Novosibirsk–Omsk line will be electrified. The whole track will be laid with new and heavier rails and it will be strengthened in order to carry the heaviest goods engines of the "Felix Dzerzhinski" type, powerful electric engines, and heavy high-speed trains. As a result of this the Siberian main line will become one of the most technically advanced and powerful main lines, capable of fully meeting the requirements of the Ural-Kuznetsk Combine, the construction of which is being completed, and also of supplying the necessary inter-regional connections between the Central Industrial Region, Eastern Siberia and the Far East.

It is evident that the creation of the Ural-Kuznetsk Combine has caused a considerable increase of the

goods and passenger traffic between the European and the eastern part of the U.S.S.R. During the Revolution it has increased almost six times as compared with the pre-war period. In 1913 this amounted to 1·7 million tons and in 1932 it reached 10 million tons. Moreover the relation between the loaded and empty runs has materially changed. In 1913 the main flow went from Siberia to the centre ; full use of the line was made for timber and grain, but the flow from Central Russia to Siberia was very small at that time.

In 1932 this state of things was radically changed. The flow from the centre of the Union to Siberia increased considerably more than that in the opposite direction, this being the result of the tremendous rate of construction in the east. As a result the flows to Siberia and back were more or less equally balanced. The intensive growth of inter-regional relations between the eastern and the European part of the U.S.S.R. was hindered by the limited and unsatisfactory conditions of the main line built by the old Russia. Tsarist Russia carried on its insignificant communication with the east by means of two single-track lines of low capacity.

The first main line (the northern one) went from Petersburg through Vologda, Viatka, Perm to Sverdlovsk and on to the east. In the Moscow region it was joined by another line through Moscow–Jaroslavl–Danilov–Vologda. The second or southern main line went from Moscow through Riazan,

Ruzverka, Syzran, where there was a branch from the Ukraine, through Valougky–Povorino–Rtichev –Penza–Syzran ; below Syzran these two lines were connected with the Urals and Siberia by a single-track main line, passing through Samara–Ufa–Berdiuch–Cheliabinsk and on to the east.

The Soviet Government could not rest content with such a low capacity on one of the most important transport lines for the economic development of the country.

Transport to the east began to improve in a decisive manner after 1917. First a third line to the Urals and Siberia was built. For this purpose a small track directed to the east, namely the Moscow–Moorom–Arzamas line, was continued for 255 km. to Konasch, and then through Kazan–Agryz–Drugino to Sverdlovsk by laying down a new line 855 km. long from Derbyshy to Sverdlovsk. Thus in addition to the two single-track lines inherited from Tsarist Russia a third line was built. But even this measure could not satisfy the quickly growing needs for transport between the European part of the U.S.S.R. and the east, including transport between the Ukraine and the Urals. To increase these transport facilities a second track was laid on the southern main line Cheliabinsk–Ufa–Samara–Syzran, and the same was done on the southern line Syzran–Penza–Rtichev–Povorino–Valougky. In addition to this, in 1927, a line 380 km. long was added from Nizhni-Novgorod (now Gorki) to Kotelnichy, and in 1933

a new railway bridge across the Volga was built near Gorki. This improved the transport facilities between various regions in the centre of the U.S.S.R. and the Urals. Transport could now be effected along the main line Moscow–Gorki, Novyi Most–Kotelnichy–Viatka–Perm–Sverdlovsk.

The task of constructing the Volga–Don Canal has been included in the second five-year plan. This canal will establish river communication between the Donbas and the Urals. In particular it will make it possible to send flotillas of barges along the Kama and Volga. Up to now the barges have gone as far as Stalingrad and their cargo has there been transferred to the railroad, to be shipped further to the Ukraine and Donbas. The Volga–Don Canal will create an uninterrupted water route to the Ukraine and thus save the reloading of a considerable amount of goods at Stalingrad. Besides the reconstruction work increasing the capacity of the Kama–Volga basin and later that of the Kama–Volga–Don, direct navigation has been organised between Moscow and Ufa, which is at present carried through the river system Moskva, Oka, Volga, Kama and Belaja.

Thus the great work performed since 1917, especially in the construction period including the first five-year plan, has led to a considerable increase of transport communications between the European and the eastern parts of the U.S.S.R. Still further work, for the creation of railway and

water routes of great capacity, to meet the increasing flow of cargo from the centre to the east, is planned in the second five-year plan.

The outlets from the Ural-Kuznetsk Combine to Eastern Siberia and the Far East have had to be increased. The growth of the cargoes carried by railway and water transport is a striking illustration of the development of the economy of Western Siberia, the autonomous republic of Buryat-Mongolia and Yakutia, as well as of the Far East. Thus, for example, in 1913 the total weight of goods sent by railway from these regions was two million tons ; in 1932 it was over ten million tons. The Lena River basin has increased its cargo turnover to 60 thousand tons, while in 1913 the volume of transport there was negligible, and the Amur River main line in the south of Eastern Siberia and the Far East increased its goods transport from 220 thousand tons in 1928 to 650 thousand tons in 1932.

The north of Eastern Siberia and the Far East, with the Indigirka and Kolyma river basins, are served by the northern route through the Behring Straits and the Arctic Ocean. The transport connections with the Yakut republic have been improved by the building of motor roads. In addition to the Irkutsk–Kachuga motor road, a new important Angara–Lena motor road was built during the first five-year plan.

CHAPTER X

THE DEVELOPMENT OF TRANSPORT IN KAZAKSTAN

THE CREATION of the Ural-Kuznetsk coal and metal combine on the one hand, and the development of the economy of Kazakstan and Middle Asia on the other, demanded the establishment of efficient transport communication between these two regions. There was no direct railway communication between Siberia, Kazakstan and Central Asia, and the communication between the Urals, Kazakstan and Central Asia was very weak and indirect, involving a detour for several hundred kilometres through Ufa–Samara–Orenburg and on to Tashkent.

The Samara–Orenburg–Kazalinsk–Tashkent railway, built under the Tsarist régime, was primarily of strategic value, having almost no economic significance. The goods traffic between Tashkent and Orenburg in 1913 was only from 500,000 to one million tons. Tsarist Russia did not pay any special attention either to the development of transport in Kazakstan itself, where the chief means of transport

were camels, or to its connections with other regions. A vast area, five times the size of France and six times the size of Germany, up to 1917 had only 2,365 km. of railway line, i.e., the line through Samara–Orenburg–Kazalinsk–Tashkent. This line did not pass through the most important regions of Kazakstan. The whole central and still more the eastern and northern parts of Kazakstan were completely lacking in railway transport. And this in spite of the fact that Kazakstan is rich in various mining products—oil, coal, iron, copper and polymetallic ores, fire-clay, lime, common and Glauber's salt—not to mention a great quantity of fish and conditions favourable for stock-raising and agriculture. All these were neglected and remained in an undeveloped state.

After the delivery of Kazakstan from the White armies of Kolchak and Dutoff, the Kazak Socialist Autonomous Republic was formed on August 26, 1920. The development of the economy of this vast region of the U.S.S.R. took a new course.

From the moment of the formation of the Kazak Autonomous Socialist Republic serious geological investigation of the Karaganda coal-mines was undertaken. As a result of these investigations a considerable area of rich coal-seams was discovered in Karaganda. In February 1931 the first Karaganda coal was received at Kuzbas, and experimental coking was undertaken. It gave good results, yielding good, hard grey coke suitable for smelting. Thus the

significance of the Karaganda basin considerably increased as it was not only a source of energy but—and this was far more important—a source of fuel for metallurgy. Large mines were promptly developed. A route to the Southern Urals had to be created for Karaganda coal, in order to supply Magnitogorsk iron-works. For this purpose it was necessary to cope with a distance of over 700 km. without any railway lines. And gradually a new main line branched off the Siberian track. It began to grow to the south through Kazakstan. In 1927 a part of this line, 264 km. long, had been built between Petropavlovsk and Borovoe and in 1931 it was prolonged 452 km. further to the south through Akmolinsk as far as Karaganda. A new main line 716 km. long came into existence. As a result of this there was a rapid increase in the output of Karaganda coal, which reached 740,000 tons in 1932, as against 66,000 in 1913. During the second five-year plan the Karaganda mines are to yield 7·5 million tons of coal and thus increase their share in the total output of the Soviet Union to five per cent.

Simultaneously with the investigation and development of the Karaganda coal basin the biggest copper mines, not only in the U.S.S.R. but in the world, were discovered on the north shore of Lake Balkhash, 500 km. to the south of Karaganda.

The construction of a Balkhash copper combine is being proceeded with; for this purpose the

communication by water through Lake Balkhash, the new ships on the River Ily, and the newly built Turksib railway, are being used. But this does not solve the problem of providing sufficient transport for the copper combine which is now being built. Therefore in order to completely solve this problem the Soviet Government decided to extend for 507 km. as far as Lake Balkhash, the already existing railway line Petropavlovsk–Borovoe–Akmolinsk–Karaganda. The construction of this line is going ahead at full speed, and in the near future this region of Kazakstan will be connected with the general railway system. The old line of the Orenburg–Tashkent railway has been considerably improved. Formerly there existed only a very inconvenient and devious line of communication between the Urals, Kazakstan and Central Asia, by the Cheliabinsk–Ufa–Samara–Orenburg line.

At present a new and shorter route, 659 km. in length, has been constructed from the Urals to Kazakstan and on to Central Asia through Troitzk–Omsk–Orenburg, which considerably facilitates the supply of Kazakstan and Central Asia with Ural timber, metal ware, and agricultural machinery, including tractors and other consumption goods. The flow of cotton, fruit and meat in the opposite direction has increased. Finally a third route to Kazakstan has been opened by building the Turkestan–Siberian main line, which covers the whole area of Kazakstan and thus connects it with Western

Siberia. The Turksib railway is of great significance not only for Kazakstan but for the whole of Western Siberia and Central Asia.

Such an extensive construction of railways in Kazakstan, as well as a considerable increase in other transport routes, has greatly influenced the development of the economy of Kazakstan. During the first five-year plan Kazakstan proved to be one of the main bases for non-ferrous metallurgy, and increased its share in the production of the U.S.S.R. to 10 per cent.

Big non-ferrous metallurgical works have been built, and more are in process of construction, for instance the Dez-Kazgan copper works, Kazpolymetal in Chimkent and the Ridderovo Combinat. The very large copper combine Pribalkhashstroi is under construction. The exploitation of the rich coal basin of Karaganda is being developed on a large scale, this basin being the third largest coal producer in the Soviet Union. In the field of chemical industry the construction of a big chemical combine in Aktubinsk was undertaken during the first five-year plan ; this provides fertilisers for the cotton fields of Kazakstan and Central Asia. Simultaneously with the development of heavy industry the construction of factories for the food and other light industries is going on. A fruit and vegetable combine, a big wool-washing factory, a powerful meat combine in Semipalatinsk and a number of others are being built. The sowing area has increased from

3·75 million hectares in 1928 to 5·6 million hectares in 1932.

The share of technical plants, especially of those new to Kazakstan (beetroot, and rubber plants), has greatly increased. The organisation of large Soviet cattle and grain farms, collectivisation together with the introduction of a high machine technique, has produced fundamental changes in the organisation of agriculture. All this in its turn has made new demands on transport. The development of railway transport from Kazakstan is given in the following table :

RAILWAY GOODS TRAFFIC FROM KAZAKSTAN

Years	*in million tons*	*Share of Kazakstan in the U.S.S.R. total*
1913	0·9	0.7
1925–26	0·95	0·8
1932	4·5	1·66

In future the economy of the country will be developed still more intensively, which in its turn will increase the transport work required.

CHAPTER XI

THE TURKESTAN-SIBERIAN RAILWAY

THE SOVIET GOVERNMENT has completed the gigantic undertaking of the Turksib railway which connects Western Siberia, rich in timber, grain and cattle, and its recently created industrial base, with Central Asia, where the main cotton production of the Soviet Union is concentrated. The question of the construction of the Turkestan–Siberian railway had for a long time occupied the more progressive minds of Tsarist Russia. This project appeared first in 1878 when a man by the name of Dubelt presented a report to the Tsarist Ministry of Transport on the immediate necessity of building the Turkestan–Siberian railway. But this was not decided on then, or even twenty years later, in 1899, when the question of the construction of the Turkestan–Siberian railway was discussed for the second time in the Ministry of Transport. In 1905 this question was raised for the third time, but still no decision was made. The idea of building the new railway was completely abandoned by the Tsarist Government.

The Soviet Government took up the question of building the Turkestan–Siberian railway in a different manner. It started from the fact that Kazakstan has such possibilities for the development of cotton production as would free the textile industry of the Soviet union from the necessity of importing cotton. Even in 1913 the total yield of cotton in Central Asia and Kazakstan amounted to 244,000 tons, the import being 193,000 tons. The area occupied by cotton in 1926–27 amounted to 26 per cent of the total irrigated area of Central Asia. The rest was occupied by grain and other products. The question of enlarging the cotton area, involving new irrigation, and even more at the expense of grain and other products in Central Asia, was definitely put forward. To solve this question it was necessary in the first place to provide Central Asia and Kazakstan with an uninterrupted supply of grain and other goods. This object was to be fulfilled by the Turkestan–Siberian railway, by means of which a large flow of grain from fertile Siberia as well as some areas of Kazakstan could be directed to Central Asia.

Simultaneously with a considerable supply of grain, a considerable supply of timber would traverse the Turksib railway from the rich forests of Western and Eastern Siberia to Central Asia. Balancing the main flow of grain and timber, metals and cattle from Western Siberia to Central Asia, cotton, fruit, etc., would go from Central Asia and

Kazakstan and Western Siberia. This economic relation between Siberia and Central Asia emphasised in all its urgency the necessity of building the Turkestan–Siberian railway in the shortest possible time. It was beyond doubt that this line was necessary and would provide enormous assistance in the development of industry, agriculture and the trade turnover of the regions through which it would pass.

In December 1926 the Soviet Government decided to build this railway, 1·441 km. in length, at the cost of 203·5 million rubles. Turksib was built under difficult conditions. Its route lay far from the industrial centres of the U.S.S.R., in a little explored and sparsely populated desert area, with difficult contours ; great difficulties faced the constructors. But workers and engineers understood the responsibility of the task set by the Government, and they worked enthusiastically. After three years and a half, on April 28, 1930, the Turkestan–Siberian railway was completed.

Only three years have passed since Turksib entered the ranks of the railways of the U.S.S.R., and these three years have been years of intensive growth in Central Asia. A striking example of this growth is not only the absolute growth of goods traffic on the railways, for the period 1928–32, but also the growth of the relative share of Central Asia in the total goods transport of the country.

In 1913 the railways of Central Asia transported about two million tons, and in 1932 the goods traffic

on the railways was over five million tons, the relative share of Central Asia in the total for the U.S.S.R. having risen from 1·6 per cent to 2 per cent between 1928 and 1932. The Central Asiatic basin, including Lake Balkhash, increased its goods transport from 40,000 to 440,000 tons, i.e. ten times.

Turksib has strengthened the inter-regional connections between Central Asia and other regions of the U.S.S.R. Formerly Central Asia had two railway lines that connected it with other regions of the U.S.S.R. The Tashkent–Krasnodarsk line connected Central Asia with Transcaucasia through the Caspian Sea, where it received oil products. The North Caucasus provided grain, while the Volga water route provided it with a certain amount of timber. There was also a second line to the centre of the U.S.S.R. by means of the Tashkent railway through Kazalmok–Orenburg, by which cotton was sent, and also to the Urals, from which it received timber. At present, since the construction of Turksib, Central Asia has obtained a third line which connects it with Siberia, from which it receives grain and timber; and in connection with the construction in Western Siberia, in Novosibirsk and Barnoul of a new big textile combine, cotton will travel along Turksib from Central Asia to Siberia. In the future Central Asia will be given a fourth line that will facilitate and strengthen its connections with the Urals. This line will be formed by the northern line, now under construction, which

is being continued through Karaganda to Lake Balkhash and Central Asia. As a result of a strengthening of the inter-regional connections in Central Asia, the latter will be provided with the necessary amount of grain and timber which in its turn will allow it to increase considerably the cotton area at the expense of the area now occupied by cereals. The development of cotton growing on this basis has already enabled the Soviet Union to supply its textile industry entirely with Soviet cotton. Thus, for instance, while in 1915 in Tsarist Russia the cotton sown area covered 690,000 hectares, in 1929, on the eve of the exploitation of Turksib, it covered 1,060,000 hectares, and after the completion of Turksib in 1933 it amounted to 2,050,000 hectares, 1·3 million hectares of which were in Central Asia. The greatly increased area and crops of the cotton fields enabled the Soviet Union to increase the total production of raw cotton from the 7·4 million bales obtained in 1913 by Tsarist Russia to 13·2 million bales in 1933. Thus with the help of the Turkestan–Siberian railway the Soviet Union has solved the problem of cotton.

But not only agriculture, and especially cotton, have developed in Central Asia since the construction of Turksib and the strengthening of the old routes through Krasnozavodsk and Orenburg. The industrial basis has also been developed. The construction of a big works for agricultural machinery in Tashkent; the building of the Ilyitch

metallurgical works with a large department for iron production ; the powerful Chirchiksk electric station and a combine for nitrogenous fertilisers for the cotton fields ; the development of mining and non-ferrous metallurgy ; the building of a very large sulphur plant in the Kara-Kum desert ; the exploitation of mitabilite in Kara-Bugas ; the development of the oil industry ; the coal industry producing 700,000 tons of coal in 1932 ; the development of a number of food and other light industry enterprises—all this has created a solid industrial basis in the republics of Central Asia. During the second five-year plan the economy of this region will show a still sharper increase, and this will require a further intensive development of transport in Central Asia.

CHAPTER XII

CONCLUSION

MUCH HAS BEEN DONE by the Soviet Government in its fight with the bad roads of Old Russia. New construction has been carried out, a new motor and air transport has been created, a considerable reorganisation of transport routes and other sections of the unified transport system of the U.S.S.R. has been effected, means of communication between different regions as well as in the regions themselves have been strengthened. But all this still does not satisfy the greatly enlarged requirements of the country for transport.

The industry, agriculture and the trade turnover of the country are growing, the economy of the formerly neglected, semi-civilised regions is developing, the level of cultural and material conditions of the workers of the U.S.S.R. is rising, and all this makes new demands on transport.

Up to the present its development has been considerable, but it still lags behind the general development of the whole economy of the Soviet Union. That is why the Party and the Government

consider the development of transport one of the first and most important tasks. In the second five-year plan special attention is paid to the problem of transport in the U.S.S.R. The fight for a complete solution of the transport problem in the U.S.S.R. is directed in the second five-year plan to the following points :

(1) A more rational distribution of relations between different kinds of transport, based on their extension ; still more rational distribution of the considerable reconstruction planned by the second five-year plan, especially a more decisive strengthening of transport between different regions as well as inside the regions themselves.

(2) A more powerful mobilisation of all the considerable inner resources of the united transport system, by means of a decisive improvement of the definitely planned regulation of all kinds of transport, a radical improvement in repair work, an improvement of the political, cultural, material and technical level of transport workers and a more rational exploitation of all existing means of transport.

(3) The fulfilment of a new programme of large-scale construction, the creation of new important railway and water main lines between different regions, as well as of new transport routes. The fulfilment of a further programme for the reconstruction of all kinds of transport ; trains, mechanised loading, reorganisation of signalling, and a better supply of main lines with modern technical devices,

new powerful locomotives, electric motors, Diesel motors, steamers, special trucks with high carrying capacity, motor lorries and aeroplanes.

(4) The accomplishment of a rational distribution of productive forces in the country with the aim of facilitating the work of transport, by locating industry near the sources of raw material; more rational and equal distribution of industrial and agricultural centres on the territory of the Soviet Union; development of local fuels, especially in regions like Moscow, Transcaucasia, Central Asia, North and Western Siberia and the Far East; the development of metallurgy, machine-building, chemical, food and other light industries in new regions; the creation of a new oil-base in the east of the U.S.S.R., and the development of local industries.

(5) The provision of transport with new staffs of engineers and qualified workers and an improvement of their material and cultural conditions.

The completion of the second five-year plan will make possible the solution of the problem of transport in the U.S.S.R. and create an exceptionally powerful and well-equipped transport that will satisfy the requirements of the country, which is completing the technical reconstruction of its whole economy.

We have no doubt that the second five-year plan will be accomplished with no less success than the first. Powerful productive forces of the country have

been set in action—forces of which neither the old Tsarist Russia, nor ten years ago even the young Soviet Republics, could have dreamed. And these forces are controlled by the working masses of the U.S.S.R.

INDEX